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DIAGNOSTICS

OF THE

DISEASES OF CHILDREN

BY

LE GRAND KERR, M.D.

PROFESSOR OF THE DISEASES OF CHILDREN IN THE BROOKLYN POSTGRADUATE MEDICAL SCHOOL; PEDIATRIST TO THE SWEDISH HOSPITAL IN BROOKLYN; ATTENDING PEDIATRIST TO THE WILLIAMSBURG HOSPITAL, BROOKLYN

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PREFACE

DIAGNOSIS of disease in the adult takes advantage of the subjective as well as of the objective symptoms. And in nearly every instance the physician may secure a clear history of the present and previous conditions.

But diagnosis of disease, or the discovery of conditions which may lead to the establishment of disease in the infant and child, encounters many difficulties. The infant cannot define his feelings, and the accuracy of the older child's definition is proportionate to its intellectual development. For information as to the child's feelings and the history of the condition the physician is in great measure dependent upon the observations of an over-anxious parent or a disinterested nurse-maid, and under ordinary circumstances either of such observers is apt to be inaccurate.

Confined, therefore, largely to the objective symptoms of disease, their correct interpretation is of absolute importance. For this reason among others I was led to write upon this subject. It is my hope that this volume may be the means of stimulating a closer study of the child life; may, in short, do something to secure for the child a "square deal" in the practice of medicine.

One aim has been kept constantly in view—to be practical, to help those who are engaged in the general practice of medicine to an early recognition of disease when it occurs in a child. Just so much of etiology and pathology have been introduced as is useful in diagnosis, and the sequelæ of diseases are considered only as they are helpful in the identification of immediate or possible dangers. It has been my endeavor to approach the subject as the child is approached in the sick-room, with the idea of arriving at right conclusions.

The usual custom of dividing the work into two parts, considering differential diagnosis separately, has not been followed.

I have tried to impress the importance of an early diagnosis by taking up the differential diagnosis even under the circumstances where there are present only the few symptoms of the onset of some disease. Under appropriate headings the symptomatology of each disease is fully discussed, so that its recognition may be marked clearly.

A large part of what is worth while in what a man says and does has been caught by the contagion of great characters in great teachers and great books. It may be that these teachers have "gone on before" and that their books are out-of-date, but their influence abides. For the inspiration of these men and their books, the encouragement of my fellow-practitioners and friends, and for the appeal of the mother's words and eyes which have driven me to harder endeavor, I am profoundly grateful.

I would especially acknowledge the great kindness of Dr. C. B. Bacon and Dr. N. T. Beers, for suggestions and help in the making of photographs for use in this volume, and to Dr. C. D. Napier, Dr. J. M. Winfield, and Dr. G. F. Little, for the use of illustrations.

I would err in gratitude if I failed to acknowledge the uniform courtesy and hearty coöperation of my publishers, who not only do, but are cheerful in the doing.

LeGrand Kerr.

110 Cumberland Street, Brooklyn, New York.

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KERR

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EXAMINATION

The examination of children offers difficulties and peculiarities which are not patent in the adult. The greatest contrast to adult life is exhibited by the infant (by which we mean the child under two years of age). After the end of the second year the contrast becomes progressively less, until the end of the seventh year, when the child more closely approximates the adult than the infant. However, during all of this period, and continuing on to and through the period of adolescence, there are marked differences which relate particularly to etiology, pathology, symptomatology, diagnosis, and treatment.

The idea that just as soon as a child is able to express its wants and feelings it becomes an adult in miniature is far from the truth. The child bears to the adult a relation of potentiality; nothing more. A complete description of all the changes in the economy which mark the child as being distinctively different from the adult would include each element of mental and physical growth. Even a general recognition of these differences shows to one the error of applying exactly the same methods of diagnosis as obtain in the adult.

There must be a thorough knowledge of the normal child at the different periods of its development and growth. Also an intimate knowledge of the morbid tendencies which are peculiar to each of such periods, and a clear understanding of the fact that from slightly active causes the child, with its unstable equilibrium, is very apt to exhibit the most varied and irregular disturbances.

By far the greatest amount of information regarding the child is obtained by observation, so that the close study of symptoms must frequently displace the more exact measures of diagnosis which are useful in adult life.

It is not only helpful, but it is important that the chief of the child's mental traits and powers be kept in mind, so that advantage may be taken of these to secure at least a partial coöperation in the examination. The most noticeable power is that of attention. Not only is there the power of attention to direct itself toward any object which is presented, but there is often an inability to avoid doing so. The things which are going on about the little one command its attention, so that the child gives it instinctively without any effort of the will. This is true in part because curiosity is so strong at this period of life.

Activity is another of the more prominent traits of the child; it is naturally restless, not being willing to remain long in one position, and not being able to concentrate its mind long upon any one thing. The result of this activity often shows itself in what we call frivolity, the child delighting in constant change and play.

At no time in life is imagination so vivid or intense as in early childhood. All the child's playthings are to its mind endowed with a certain amount of life and feeling. Two or three lines crudely drawn will be transformed by the child into an animal, house, or anything which the fancy of the one who draws them suggests. Advantage may be taken of this, for by using these strong imaginative powers the physician may secure a considerable amount of coöperation by a few moments spent in tactful approach.

Knowing that the child rebels against restraint, this must be avoided until all of the data possible have been secured.

Subsequent examinations are easier if the affection of the child is won, for affection is very strong during childhood.

The approach to the child should in most instances be very gradual, for the attendant must remember that he is dealing with an irrational, easily frightened being, whose disease has probably irritated and exhausted it to such an extent that it lacks self-control.

There are no hard and fast rules by which we may expect to win the child's confidence: one case requires to be absolutely ignored for the time being, while a history of the condition is being obtained; another must be approached at once. With a child of the latter class it is best that the physician retire at once at the first sign of rebellion at his presence, and obtain the full history of the case, after which the approach must be firm, to convince the child that you are master of the situation.

The history of the present illness is naturally the first thing to be elicited, and this is best done by a leading question put to the parent, as, "Of what does the child complain?" (The ordinary question, "What is the matter with the child?" will usually meet with the response, "I do not know.") Only under exceptional circumstances should there be any interruption as the history is given. Full scope should be allowed to the parent to tell all about the child's condition, and meanwhile the physician should be studying two things: the history as given, and the temperament of the one who gives it. This latter is quite important, as there is a tendency in some to withhold knowledge of certain symptoms, or so to exaggerate particular ones that really important ones are overlooked.

On the other hand, there are those who wilfully enlarge upon all the symptoms in order to excite the interest of the physician, or from some morbid tendency. The largest number deceive unintentionally, through the habit of the loose and inaccurate use of words.

In older children who show a normal degree of intelligence a few questions put to the child will be a valuable supplement to the history already obtained.

The history obtained in the foregoing manner will, in nearly every instance, be incomplete. Different methods of elucidating the history will suggest themselves, according to the temperament and intelligence of the history-giver. The time spent in obtaining a full and complete account of the child's present and previous condition is never wasted.

It is not necessary that the history be given in a concise way: the main thing is that the physician have in his own mind an orderly arrangement of the symptoms, in order to arrive at a

right conclusion as to further investigation. It may be necessary, in order to do this, to ask a few pointed questions.

The statement as regards the time of onset will place the disease in one of two categories—acute or chronic. Nevertheless, it is essential to learn, if the attack is acute, whether it is dependent upon some underlying chronic condition. From this, an endeavor should be made to arrange the subsequent symptoms in the order of their appearance up to the time of examination. If the child had been previously treated, completeness demands that the therapeutic measures used be known.

What is the age? is a question the answer to which will largely influence the diagnosis. There are many diseases the frequency of which is determined by the child's age. Diseases of the new-born give evidence of their existence at birth, or within a few days of that event. This is true also of many injuries which are consequent upon the character of the labor. Included in these we observe caput succedaneum, cephalhematoma, hematoma of the sternocleidomastoid, visceral hemorrhage, obstetric paralysis, tetanus, asphyxia, atelectasis, ophthalmia neonatorum, etc.

The occurrence of convulsions in a very young infant would have a far different meaning from, and lead us to a different conclusion than, a similar condition in a child six or seven months old, and more still if it occurred after the third year.

Undoubtedly the best illustration of this influence of age is afforded by icterus, a thing which in the new-born we disregard and look upon as physiological, but when it occurs in an older child is a very important symptom.

During the first year of life diseases affecting the mucous membranes of the gastro-intestinal tract and nutrition largely predominate.

From the sixth to the thirteenth month, and through the period of weaning, there exists a tendency to affections of the mouth, eclampsia, and catarrhs of the large and small intestines.

During the second year diseases show a marked preference for the mucous membranes of the respiratory tract, but the gastro-enteric diseases are still important factors.

From the second to the sixth year the acute infectious diseases are common. After the third year catarrhal inflammations of

the respiratory organs, tuberculosis, and diseases affecting the heart are most frequent.

The previous condition of the child is the next step. Was the child full term or abortive? If the latter, there is quite sufficient reason for the child remaining weak and anemic for a long time. An abortive infant is also more liable to all the infections, and shows a very marked tendency to become rachitic.

Was the delivery of the child protracted? If so, it may account for a subsequent epilepsy or mental deficiency; or if difficult, but not necessarily protracted, for spastic hemiplegia and some other nervous diseases.

How was the child fed? This question is of prime importance, and much care should be given to secure an answer, minute in its details, covering the whole period from birth to the present time. If breast-feeding was employed, it is essential to find out whether the infant was nursed by its mother or a wet-nurse. If by the latter, was there one or more who nursed the patient?

In either case, what was the quality of the milk? Was the infant satisfied, and how long was it allowed to nurse, also at what intervals? Too long or too frequent feeding is a prolific cause of gastro-intestinal disturbances. Were one or both breasts used, and if both, were they used alternately? For the suckling of one breast twice in succession would greatly influence the quality of the milk withdrawn.

The health of the nurse should be inquired into, also her diet, and whether she is menstruating or is pregnant. Periodical attacks of dyspepsia, with the consequent colic and restlessness, may depend upon menstruation in the nurse.

With bottle-fed infants it is necessary to know accurately the source of the milk (can milk is not fit for infant feeding); also the strength of it, and with what the dilution was made. Diluents containing any considerable amount of starch would be very apt to be harmful in infants under three months of age.

As has already been stated under breast-feeding, the amount of food given at each nursing and the intervals between nursings are both very important. Nearly every infant, if left to itself, will overfeed, and almost every mother, unless instructed, will fall into the error of overfeeding the child. Herein is laid the foundation

for diseases which appear later on. If there have been additions to the nursing (as the giving of thin soups, coffee, etc.), in just the proportion that they are given early, before the eighth month, will there be disturbances from them.

The time of the eruption of the teeth should be gone into, espe-

Fig. 1.—The teeth between six and eight months.

Fig. 2.—The teeth two months after the appearance of the two lower central incisors.

cially as to whether it was delayed (which is often the case in an infant poorly nourished although obese); and was the cutting of each tooth accompanied by any disturbance? Some difficulty will be here experienced, because the average mother will attribute to the teeth all disturbances which occur during the time that the child should be teething.

Fig. 3.—The teeth between the twelfth and fourteenth months.

Fig. 4.—The teeth between the sixteenth and twenty-second months.

Generally speaking, the deviation from the average in regard to teething is a fair indicator of the general nutrition of the infant. There may be normally a wide variation in the time of the appearance of the teeth in the infant, but there should be quite constant

regularity in the order of the appearance. The average order and time follows:

Between six and eight months, the two lower central incisors.

Two months later, four upper incisors.

Four months after that, two lower lateral incisors and four anterior molars.

Six months following, four canines.

Another six months, four posterior molars.

The average healthy child will be able to hold its head up steadily at the fourth month and will sit alone by the end of the ninth month. The child will walk between the twelfth and seventeenth months. It is important to learn if the child has walked and then ceased to do so. Unless this can be explained without doubt, it is strongly indicative of rachitis.

If the child is one of several in the family, it is of some value to know the general physical condition of its brothers and sisters, and in case some of them have died, the cause of such death should be learned. Where the family is a large one, inquiry ought to be made as to the time between the births, as rapidly recurring pregnancies not only debilitate the mother, but have a decided influence upon each succeeding child.

Fig. 5.—The teeth between the twenty-second and the twenty-eighth months.

A knowledge of the diseases from which the patient has previously suffered is of much value, provided a fairly accurate account of their nature, date, and severity can be obtained. Previous attacks of certain diseases predispose to subsequent attacks. Among this group we find bronchitis, repeated convulsions, either infantile or epileptic, erysipelas, malaria, pneumonia, tonsillitis, and rheumatism.

On the other hand, a previous attack renders a subsequent attack less probable in the following: rubeola, rötheln, scarlet fever, typhoid, variola, varicella, varioloid, and whooping-cough.

Certain other diseases arise as sequelæ, so that a history of the

primary affection throws some light upon the present condition. Chief among these are otitis, renal disease and rheumatism following scarlatina, skin eruptions, nervous affections, ulcers and periostitis from hereditary syphilis, and heart lesions in rheumatism (a most frequent occurrence).

GENERAL POSTURE

The position which a child assumes while in bed is quite often significant. The attitude of the child may, on the one hand, be reassuring, as we note that the little one rests easily and sits up or turns to greet the physician. It assures one that the ailment is slight, or that convalescence is well established. When the child refuses to notice or play, we may be sure that the illness is of a severer type.

The side position is assumed characteristically in two diseases—acute pleurisy and pneumonia. In both cases the child lies upon the affected side so as to limit as much as possible motion of the diseased side and to allow free expansion of the unaffected. In pneumonia it is not difficult to get the child to change its position, but in pleurisy there is a decided objection to this procedure, which most often amounts to absolute refusal.

If the child is pale and thin, indicating that the illness has been a long one, and the breathing is very much interfered with, we can be almost certain that there is a large exudate, and a light percussion would be sufficient to exclude pneumothorax.

The dorsal position—(*a*) with slightly bent legs, is the position of election in cases of acute peritonitis and tubercular peritonitis. Motion is carefully avoided, and in acute peritonitis there is generally evidence of fear as the child is approached.

(*b*) With thighs and also the knees strongly flexed and more or less rigidity of the leg of the affected side the dorsal position occurs in perinephritis, but is a very late sign. The child may further be tested by the standing position, when the hand will be rested upon the knee of the affected side, or slightly above it, and the back will be slightly bent, with the concavity of the spine toward the affected side.

(*c*) With a curve of the trunk slightly toward the right side

and with the right knee more or less flexed, or in some cases held up by the child, which gives relief to some extent, the dorsal position is assumed in appendicitis.

(*d*) With the body held rigid, a strong disinclination to move at all, and the head elevated, the dorsal position occurs in pericarditis. But pericarditis is a rare disease in young children.

On the abdomen is the position taken in—(*a*) some cases of Pott's disease, but it is by no means characteristic; (*b*) in phlegmons of the back (to relieve the pressure); (*c*) and to eliminate

Fig. 6.—Common posture of child with lumbar abscess or phlegmons of the back.

the pain which is consequent upon much light in severe photophobia.

Under **forced positions** it is only necessary to make mention of opisthotonos and emprosthotonos, which occur in some cases of tetany, strychnine poisoning, and meningitis.

The upright or **sitting position** may assumed as the result of abdominal accumulations of fluid; from large effusions in the pericardial or pleural cavities; and it attends some cases of laryngeal diphtheria.

FACIAL EXPRESSION

The face of the average child expresses more clearly than does the adult the feelings and character of the individual. Except as the child more closely approximates the adult type, there is no attempt at deception by the facial expression. Sick or well, there is a candid frankness which allows of no exaggeration or dishonesty.

The value of facial expression as indicating diseased conditions will exist only as one appreciates what is normal; then, with the capability of comparison which comes by many observations, one can interpret the expression of the child.

The normal expression of a child while asleep is one of perfect unbroken calm and peace. The eyelids are closed, the lips very slightly parted, and the nostrils are immobile.

Normal expression plus twitching of the facial muscles is indicative of irritation of some portion of the nervous system. It may be the forerunner which indicates an impending attack of general convulsions; but if so, there is very apt to be restlessness also.

Normal expression with eyelids parted may be observed in many of the milder disorders of the nervous system and during digestive disturbances. If the muscles of the face are drawn from time to time, it strongly indicates that the disorder is a digestive one.

Listlessness (that is, marked by a relaxed attention) may be due to several causes: (*a*) After some days' illness with typhoid fever a listless expression is an almost constant feature. (*b*) If associated with motionless or seldom moving eyelids, or with wide-open eyes staring steadily into the distance, it is quite indicative of meningitis, and this condition of the eyes and the expression may help in some cases to differentiate it from typhoid. (*c*) With sunken eyes, and occurring at any time during any disease, it is a symptom of ill import, for it is then a sign of suddenly increasing prostration or impending death.

Vacant Expression.—(*a*) Associated with enlarged head, but the bones of the face remaining small, and the eyeballs perhaps slightly protruding, is seen in hydrocephalus; (*b*) with thickened lips, more or less gaping mouth, small nasal orifices, and a broadened root of the nose, is quite common in hypertrophied tonsils, and adenoids which are almost invariably associated with them.

Idiotic.—(*a*) When the expression is idiotic and the lips thickened, the tongue protruding so that saliva is almost constantly dribbling from the mouth, the nose flattened, and the skin of a pallid, waxy hue, cretinism is probably the cause. (*b*) If the same picture is presented, but in a very much lessened degree,

we may be dealing with an exaggerated form of mental deficiency.

Anxious Expression.—(*a*) With nostrils more or less dilated and labored breathing, the anxious expression is indicative of some disturbance to the circulation, and especially so if any cyanosis is detectable. (*b*) This expression is present, with sunken eyes, depressed fontanelles, a general sharpening of all of the features, with the angles of the mouth drawn and considerable pallor of the face noticeable, in cholera infantum. (*c*) If the upper lip is retracted, exposing the teeth, and along with this there is visible prostration, it is indicative of acute peritonitis. (*d*) Associated with shallow respirations and increased frequency of breathing, and the cramped position on the side, it is presumptive evidence of acute pleurisy.

Fig. 7.—Facial expression in marasmus.

Old Expression.—(*a*) With a pale, pinched, and weazened face, and associated with "snuffles" in an infant, it is indicative of hereditary syphilis. These infants look prematurely old and may also show a depression at the bridge of the nose and a prominent forehead. Such an expression is most apt to be noticed during the first two months of life. (*b*) When the skin has a leaden hue and is loose and wrinkled, one would naturally suspect marasmus. (*c*) An old expression is common to children of all ages, who are suffering or who have recently suffered from chronic starvation, and such an expression is quite in proportion to the chronicity of the condition.

Expressionless.—This is usually due to the abolition of the distinctiveness of the features in advanced mitral disease. In edema and erysipelas all the lines of expression may be lost.

Painful disfiguration of the face while pressure is being made over some distant portion of the body aids in definitely locating the site of tenderness, and sometimes of pain (pain may be referred).

The Face as Indicative of Disease

The expression is an indicator of the psychical condition of the child under observation, and has at times a distinct value as an aid in diagnosis; but, in addition to this, there are certain facies occurring during diseased conditions which are helpful in the recognition of such. Some of these facies are so characteristic that to one who understands them well they are a direct indication as to the point at which the examination may begin.

The facies of disease in childhood are not nearly so numerous as those which are encountered in adult life, so that I feel that it is best to describe them under the heading of the respective diseases in which they occur.

Nephritis.—The face is pale and puffy if edema is an accompaniment. The paleness is not that of simple anemia, but there is more of a waxy hue. The intelligence of the expression is apt to be diminished.

Pertussis.—The face is puffy and pale, as a rule, and it closely simulates the face of nephritis, but the paleness is more of the anemic type, and added to this is more or less suffusion of the eyes. Frequently the eyeballs are much injected, or may be the site of minute hemorrhages.

Hereditary Syphilis.—When syphilis is fairly well developed, the infant has a pitifully old, weazened look. The skin is dusky, yellowish, or wrinkled, and the infant suffers from *persistent* snuffles. Later the nose may become flattened and broadened. If such a facies is present in an infant a few weeks old, it is almost positive evidence of syphilis, and examination will usually confirm the suspicion, as other signs are found.

Tubercular Bone Disease.—In this the features of the child are very coarse and heavy. Usually the child is stocky, with a short and thick neck.

Chronic Malaria.—In this disease there is more or less pallor of the face, sallowness, and frequently a slight degree of puffiness, all of which would probably create a suspicion of renal disease. With a negative urinalysis the next thought should be of chronic malaria.

Mouth-breathers are a type in themselves, indicating some

interference with normal breathing through the nose. Such children have a vacant expression and hold the mouth more or less widely open. The expression of the eyes is dull and the eyelids are apt to droop. The lips are thickened and the nasal orifices smaller than normal, while the root of the nose may be broadened. All this, with the rounded shoulders and the general sluggish appearance of the child, gives a picture which is quite characteristic.

Fig. 8.—Facial expression of a mouth-breather.

Cretinism.—This gives a particularly characteristic appearance. The head, in the first place, seems too large for the dwarfed body. The forehead is low with a very much broadened base of the nose, so that the eyes are widely separated. The lips are very much thickened and the mouth is open, with the tongue protruding slightly. Saliva dribbles more or less freely from the mouth. The cheeks are baggy and loose and the hair coarse and straight. The fontanelles remain open sometimes until the tenth year, or even much later.

THE BODY WEIGHT

An intimate acquaintance with the weight of the infant in its different periods of development is of far more importance than a similar knowledge of the adult. The body weight is the most valuable guide which we possess as an indicator of the general state of nutrition. It would be hardly possible to overestimate its importance during the first two years of the child's life.

Gain in weight is, however, not the only factor to be considered,

but one must know what is the normal average for different periods, and comparison must be made with these. A fat baby is not necessarily a healthy baby (the laity to the contrary), for too rapid gain in weight may be the result of faulty nutrition.

The average weight at birth is close to seven and one-half pounds. If the new-born infant weighs less than five and one-half pounds, it is presumptive evidence that we are dealing with an underdeveloped child. Such infants are rarely healthy or vigorous, and although they may appear so at first, within a few

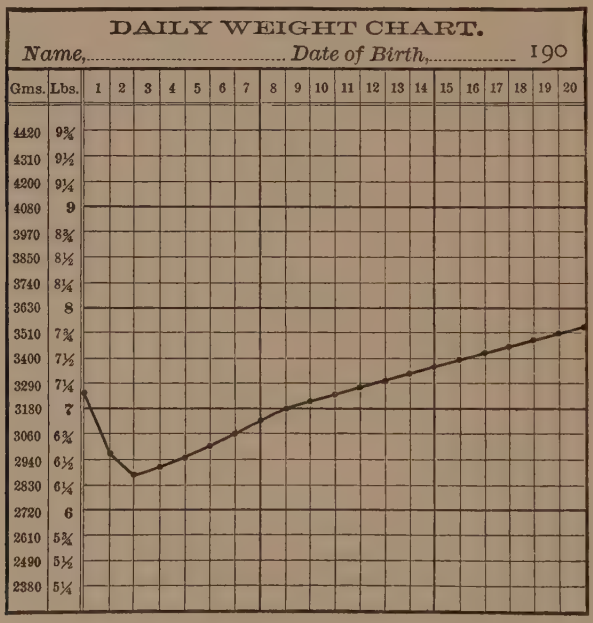

Fig. 9.—Weight curve of the first twenty days (Holt).

days they show that they are difficult to nourish and their resisting powers are very low.

During the first three or four days after birth there occurs a loss in the infant's weight which is normal. Approximately, it amounts to one-tenth of the original body weight. By the end of the tenth day, at least, this loss should have been regained and the infant be at its original weight. From this time on the gain should be progressive and steady, and this can be determined only by more or less frequent weighings.

A word in regard to the gain in weight of infants who are underweight at birth: these little ones do not reach their original body weight, after the loss of the first four days, until the end of the second or even the end of the third week.

There should be no difference in the gain in weight between the breast-fed and the artificially fed infant. In practice there will be a very noticeable difference at times, but this is due to

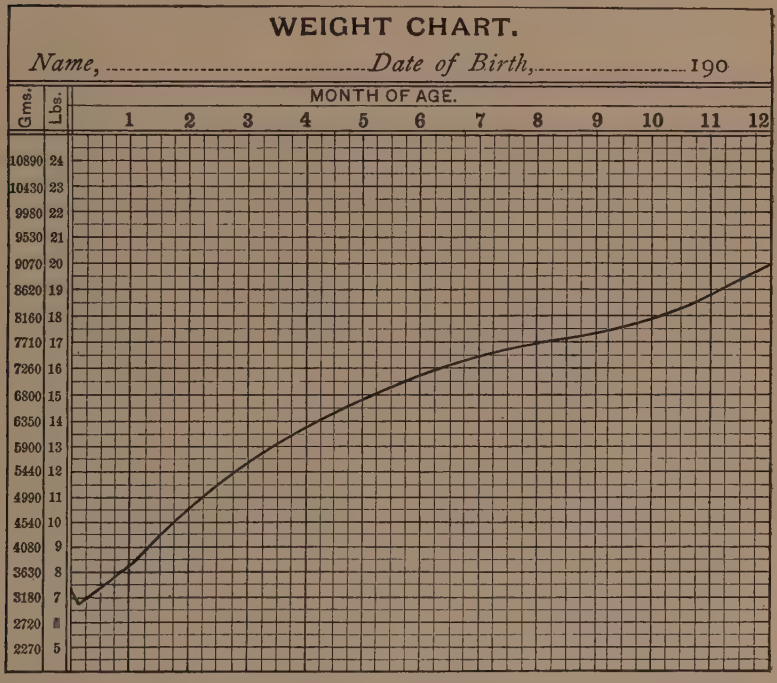

Fig. 10.—The weight curve of the first year (Holt).

faulty nutrition, and when such a difference is observed, its cause should be sought for and remedied at once.

The accompanying chart (Fig. 9) represents the variations in weight for the first twenty days of life. The curve shows a very decided loss upon the first day and a lesser one on the second. The lowest point was reached on the third day. From this on there is noticed a steady gain. The loss occurring during the first days is due to the discharge from the body of the meconium

and the urine, and also to the excess of tissue waste over the nutriment derived from nursing.

Both these weight charts are from Holt, and they represent what is the average for a large number of children. Neither must be considered as representing what the infant must weigh to be normal; normal gain would be for the little one to increase in proportion, which necessitates knowing the birth weight.

During the first year of life the greatest gain takes place during the first three months, and is slowest from the sixth to the ninth month. From the beginning of the second until the fifth year the gain is approximately as follows: During the second year, six pounds; during the third year, four and one-half pounds; during the fourth year, four pounds.

During all this period, except the second year, the gain is not steady, varying considerably with the seasons, being less in the heated term.

Loss of Weight

Loss of weight in the child may be gradual, rapid, or relative, and the distinction of the various types is very important. By relative loss of weight I mean that the gain is below what it should be in the normal infant; the infant gains, but not so much as it ought to, to constitute a healthy condition.

Unfortunately, many times we have to rely upon the statements of a parent who is careless in regard to these matters, or who disregards their importance wilfully or through ignorance. Fortunate we are if the opportunity has been ours to watch the development of the infant, or if weighings have been taken at stated intervals.

Gradual loss of weight in infancy is the result in most instances of chronic starvation. This may, in turn, be due to one or more of several factors: either the food is not sufficient in quantity, it is poor in quality, or it may be unadapted to the age and the strength of the infant.

There is also a form of chronic starvation which might be called "symptomatic," as it is an accompaniment of many other diseases, especially intestinal catarrh. This form may appear at any time of life, but usually it does not show itself until after the fourth

month. The diagnosis is made by considering the disease during the course of which it develops and by exclusion of all other causes.

Several days may be spent in determining satisfactorily that a steady loss is not due to tuberculosis. During this time several physical examinations may be necessary and the temperature should be watched over a considerable period. The absence of cough in no way influences the diagnosis of tuberculosis. The family history and a history of the surroundings of the infant are both most important.

Relative loss of weight is very common in infancy. The gain may be very slow, the muscular development and growth tardy, and the powers of digestion and resistance considerably enfeebled. Such infants may be the offspring of delicate or nervously exhausted parents, but more often they are the direct product

Fig. 11.—Marasmus—infant of five months.

of a parent's foolish care, being housed in close quarters or overheated rooms and having a deficient supply of fresh air. The characteristic thing about such infants is that all their growth is slow. This constitutes that class of infants who are suffering from malnutrition. In most instances the fault is not one of nutrition, pure and simple, but one of poor hygiene.

A very large proportion give an indefinite history of failure to keep up to standard, lasting over a somewhat extended period, until the constitution gets into such a condition that the slightest causes result in disease. It is almost impossible to determine with any accuracy when this state of malnutrition ends and its usual successor, marasmus, begins.

Steady loss is by far the most constant feature of marasmus. The general appearance of such infants is characteristic: the skin is wrinkled and lacks its normal tone, hanging in folds upon the extremities. The child has the look of an old person. The abdomen is prominent, the eyes large and with an appealing expression, and all the features are sharpened. There is apt to be a hollowing out over the temples, and the legs and arms are justly likened to drumsticks.

Anemia is a constant feature of these cases and is generally present to a considerable degree. The temperature is usually subnormal. Under causes so slight that it hardly seems possible, vomiting and diarrhea are induced. The course of the disease is steadily worse.

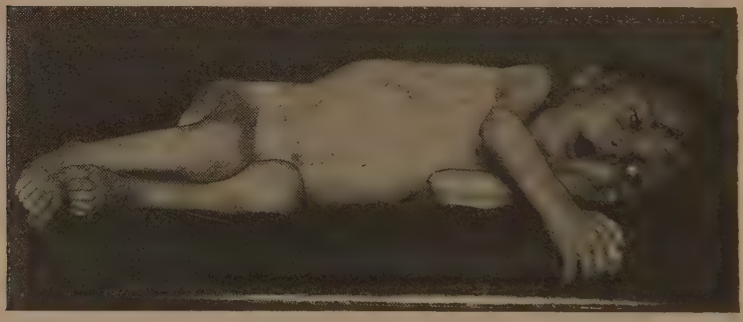

Fig. 12.—Marasmus—infant of five months.

The differentiation of marasmus from tuberculosis is sometimes very difficult, and in a few cases it is impossible during life. Posterior auscultation has no differential value, for hypostatic pneumonia, which frequently occurs during marasmus, gives no signs which are definitely distinguishable from tuberculosis. Anterior auscultation and percussion are of much more value, for if signs are found there, they are more indicative of tuberculosis than of any condition which occurs in the course of marasmus. This is especially true if consolidation is present.

The previous histories of the cases are of much value. The tubercular infant is generally *delicate from the time of birth;* in marasmus there is almost uniformly a history of *healthy early infancy*, which continued until some necessity arose for wean-

ing or for changing the food. This change has usually taken place some time during the first six months of life, and from that time the trouble began.

Rapid loss of weight is preceded in nearly all instances by malnutrition, but it may require some care to bring out this fact. Following out in minute detail the history of the child's development, we find that the little one "has not done well" for some time past. Then more or less severe symptoms appear suddenly; the loss in weight is now very rapid (three or four ounces in one day), and the temperature may be subnormal. When little or no food is taken or retained, the temperature may be quite high and a fatal result ensue within three or four days. The pulse is always weak and rapid, and evidences of considerable prostration are not wanting. There is usually marked pallor, and at times cyanosis.

In young infants there is the probability of mistaking this condition for some other disease (especially pneumonia, meningitis, or gastro-enteritis), unless we remember that following malnutrition we frequently observe this foregoing chain of symptoms, which is strong presumptive evidence of the disease with which we are really dealing—acute inanition.

Acute inanition is a condition which is induced by a lack of assimilation. Many of the symptoms which are observed during the course of the acute digestive diseases are due to inanition, but here we consider it independently of such relation.

There may be continued fretfulness with crying, or a state of semi-stupor may persist, but from this latter the infant is easily aroused. Whatever is taken in the form of nourishment seems to pass through the body unchanged. There is little desire for food, but it may be taken for several feedings and retained for a long time, when the whole amount may be vomited. The younger the infant, the more likely this is to occur.

As distinguished from malnutrition and marasmus, acute inanition is much more acute, and is rare after the child has passed the fourth month of life.

Stationary weight should at once lead to an investigation of the child's nutrition, and one must not be satisfied that the nutri-

tive processes are not at fault until the most searching examination has been made to eliminate such a fault.

During any of the acute illnesses there may be stationary weight, but when the acute symptoms are passed, the gain is again evident. During the convalescence from an attack of ileocolitis occurring in the summer months a child is very apt to exhibit stationary weight. The more the child eats, the less it seems to improve. The cause is usually found in a chronic ileocolitis of a mild type. In catarrh of the stomach and in chronic intestinal indigestion, the weight remains stationary, as a rule.

Rapid gain is observed in cretinism, general anasarca, and sarcoma of the kidney, but other distinctive signs of these diseases are present earlier than the rapid gain, so that they are recognized.

SLEEP

The tired organism demands a period of physiological rest during which there can be repair to the fatigue changes which are consequent upon physiological cell activity, and this rest is called sleep. This repose is absolutely essential for the vital activity of cells.

Normal sleep has as its constant features loss of consciousness, loss of voluntary inhibitory control of mental and motor acts, and more or less loss of all of the special senses. Normally, during the first hour sleep becomes more and more profound, but during the second hour there is lessened profundity, and thereafter it does not require a very strong stimulus to arouse the individual.

The healthy new-born infant sleeps nearly all of the twenty-four hours. During these first few days the sleep is heavy, because the organs for receiving and carrying peripheral stimuli to the central nervous system are underdeveloped. During the first month the normal infant sleeps about twenty hours and sleep is less profound during the latter two weeks than at first. From the end of the first month slightly less sleep is required, so that at six or seven months the average time spent in sleep is sixteen hours. Between the end of the third month and the begin-

ning of the third year sleep is noticeably profound during the first two hours. At the age of one year the child sleeps about twelve hours out of the twenty-four.

Disturbed sleep (that is, waking frequently) is usually due to a general nervous irritability, which may be hereditary or depend upon malnutrition. This irritable condition is exaggerated by excitement. Faults of training may be responsible. In a large proportion of instances in infants the cause of disturbed sleep is hunger. (The quantity of the food may be sufficient, but the quality poor.) Indigestion is the next most frequent cause, and in later childhood fully half the cases of disturbed sleep are dependent upon it. Overheated or poorly ventilated rooms and uncomfortable bed-coverings may be its cause. When disturbed sleep has as its accompaniment the so-called darting pains, it is quite indicative of hip-joint disease; in fact, it may be the first thing to attract attention to the existence of that disease.

Restless sleep is evidenced by the child frequently changing its position, but without awaking. In a child free from disease it is evidence of an irritable nervous system. It is a feature of all malnutritions, but is most marked in marasmus. Associated with inability to lie upon the back for any length of time it is somewhat characteristic of nasal obstruction or adenoid disease.

Uneasy sleep (when the child is restless and easily aroused) is frequently caused by indigestion, slightly painful conditions, or intestinal parasites. In children of all ages the possibility of insect bites must be recalled, and no hesitancy should be shown to have a search made to clear up any doubt upon this matter. The sleep of the anemic child is always uneasy. Fever may account for either restless, disturbed, or uneasy sleep.

Night Terrors.—This is a neurosis depending upon an abnormally irritable nervous system, easily excited by reflex stimuli in remote parts of the body. The child wakes suddenly with violent screaming and gives evidence of great terror. This may be repeated night after night. Such terrors take on the form of epileptic seizures and should be differentiated from them. Heredity plays an important rôle as an etiological factor, the particular defect which is inherited being a feeble inhibitory control of men-

tal and motor acts. Malnutrition is an important factor in developing irritability, therefore its common causes—as lymph-node tuberculosis, chronic diseases of the gastro-intestinal tract, rachitis, chronic malaria, improper food, impure air, and bad hygiene—may be important predisposing factors. Mental excitement or overwork associated with physical debility may be at the root of the trouble.

After this state of nerve irritability is once established, it requires but a slight active cause to bring about the attacks. Disorders of the intestinal tract are the most important of these reflex factors, but in many instances reflex factors may be so slight as to be undiscoverable.

Incontinence of urine may occur during an attack, or, as frequently happens, the child may make known its wants in this direction, and have evacuations of both bladder and the bowel, without giving any other evidence of being conscious of its surroundings, and having no recollection of the occurrence later on. In the presence of such attacks one must be guarded in deciding that epilepsy is not present.

Another type of night terrors is that in which the paroxysm is less severe, and the child becomes quickly conscious of all his surroundings, and has a more or less vivid recollection of all that has occurred.

Excessive sleep is almost invariably due to the ingestion of some narcotic drug, given knowingly, or more often ignorantly. Usually there is the history of the ingestion of a cough mixture or soothing syrup, which will help in the diagnosis. If drug ingestion can be absolutely excluded as the cause, we are justified in suspecting some organic brain lesion.

Drowsiness coming on during the daytime and associated with a disinclination to play, or to remain normally active, may be due to the onset of one of the febrile diseases. If there is added a change in the disposition of the child, it is strongly indicative of the development of tubercular meningitis. Occurring periodically, it may be the first thing to arouse a suspicion of malaria.

Somnambulism is a disorder of sleep whose etiological factors are almost identical with those of night terrors. While such a state is not uncommon to childhood, anything more than the

simplest movements are very infrequent. The child may walk or even run about the room, but rarely does more than this, and when aroused, is perfectly unconscious of anything which has happened. Frequently sleep-talking is associated with sleep-walking.

THE HEAD

Examination of the child's head is made by the usual methods of inspection, palpation, and measurement.

Shape.—The infant's head at birth may be misshapen or asymmetrical, as a result of the conditions existing at the time of labor. The usual deformity is an elongation (and a further modification may come from caput succedaneum), which usually rights itself by the end of the first week. Considered as a whole, the large preponderance of cranial over facial proportions is marked. The parietal eminences are large.

By the end of the first month the head should have assumed an oval and symmetrical shape. Later in life than the end of the first month any change in the shape of the child's head is not normal. The shape of the rachitic head is quite characteristic: viewed from above, the cranium is elongated, large, and square. The vertex and the occiput are flattened; the frontal eminences protrude and the fontanelle is open longer than normal.

In sporadic cretinism the head is also flattened at the top and the fontanelle open, but the whole head is enlarged to a considerable degree. The face is broad and the nose is like that of a negro, the forehead low and the eyes widely separated.

The head of the child with hydrocephalus is very large and the shape is either globular or pyramidal, the forehead being very prominent about the root of the nose.

Asymmetry of the head, if slight, may be due to one of two causes: (*a*) The habit which some infants are allowed to get into, of lying quite constantly upon one side (and that the same one), causes asymmetry by pressure. (*b*) It may occur in consequence of hemiplegia.

More marked degrees of asymmetry usually depend upon the early ossification of the sutures upon the affected side. More rarely it is due to an underdevelopment of the hemisphere.

The size of the head is best determined by a comparison with

the size of the chest, for the two are almost similar in measurement. Until the end of the fifth month of life the circumference of the head is about one-half inch larger than that of the chest. From the sixth month until the eighteenth month they even more closely correspond, so that there is normally only a fraction of an inch in difference. After the eighteenth month, and until well along into the fifth year, the chest measurement pro-

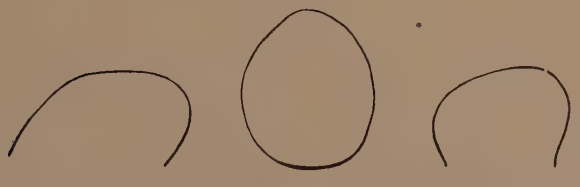

Fig. 13.

Fig. 14.

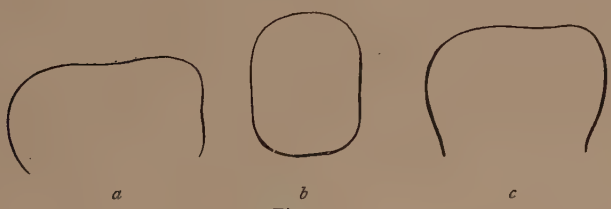

Fig. 15.

Figs. 13, 14, and 15.—Comparative cranial contours: *a*, Anteroposterior; *b*, circumference; *c*, transverse. Fig. 13, Microcephalic. Fig. 14, Hydrocephalic. Fig. 15, Rachitic.

gressively and proportionately increases over that of the head, until at the sixth year of life it exceeds it by one inch.

Such figures as these, of course, can only be taken as an average, but a difference at any time of two inches or more between the chest and head measurements should lead to an investigation for the cause.

Gradual enlargement of the head is, in the large majority of

cases, due to rachitis. The increase in size is quite slow, and usually very irregular also, and this latter (irregularity) is of considerable diagnostic import. The greatest source of error is in mistaking early cretinism for rachitic enlargement of the head, but the general torpor which is so evident, the facial expression, and the temperature should help to distinguish the former.

In hypertrophy of the brain the development of the enlargement is exceedingly slow; so slow, in fact, that it is scarcely noticeable, even over a protracted period.

Rapid enlargement is by far the most constant and characteristic feature of hydrocephalus. If the enlargement of the head is one inch or over in one month, from that fact alone one can almost certainly make a diagnosis. In a few instances hydrocephalus may exist without any appreciable enlargement of the head, for such enlargement may be prevented by the early ossification of the sutures and bones of the skull. Early death occurs in these cases, because of the pressure within the skull.

Fig. 16.—Measuring the head.

Small size of the head is determined in infancy, if the chest measurement exceeds that of the head very much, during the first year of life in particular. It constitutes the condition called microcephalus, and is indicative of future mental deficiency or even idiocy.

Baldness of the occiput is strongly indicative of rachitis. The hair of the rest of the head may be quite abundant, but at this point it looks as if it had worn off.

Sweating of the head is an early and a very suggestive symptom of all forms of malnutrition, and especially of rachitis. Fre-

quently, over a long period, it is the only symptom of a fault in the nutritive processes. It readily explains why some infants suffer so frequently from coryza. Head sweating is particularly liable to occur during sleep.

THE FONTANELLES

At birth, and existing for some time after that event, there are at the angles of the parietal bones membranous spaces, which are the fontanelles. The most important and largest of these is the anterior median (commonly designated as the anterior fontanelle), which is situated at the junction of the frontal, sagittal, and coronal sutures. Immediately after birth this fontanelle is slightly depressed. It is quadrilateral, and there is pulsation which is correspondent with the pulse frequency.

The posterior median fontanelle (posterior fontanelle) is smaller than the anterior and is triangular in shape. The other four spaces are at the inferior angles of the parietal bones and are irregular in shape. The only ones with which we can be concerned in diagnosis are the anterior and the posterior.

The size of the anterior fontanelle apparently increases during the first six months, owing to the rapid growth of the head during that period, but toward the end of the first year there is a distinct diminution in size, and ossification is usually complete by the middle of the second year. If at any time during infancy the distance between the opposite sides of the anterior fontanelle is over one inch, it should be considered pathological. The sutures begin to unite about the ninth month, so that considerable firmness is detectable.

The posterior fontanelle closes at the second month of life, as a rule, and is subject to so little variation in this regard that if at the end of the second month it is still open, it is indicative of some nutritive fault. The closure of the anterior fontanelle may be normally subject to wider variation; to wit, as late as the twenty-second month.

Delayed closure of the fontanelle is generally due to deficient or delayed ossification, which is the result of malnutrition. Of all the nutritive disturbances, rachitis is most likely to cause it, and

during the first year this may be the chief symptom which we encounter. The constancy with which this condition exists in rachitis is an important factor in its exclusion.

Hydrocephalus causes pressure from within, and in that way interferes with the normal closure of the fontanelle, provided the disease begins before there has been any considerable ossification; otherwise the pressure does not interfere with complete closure and the infant dies early from the pressure.

Slightly bulging fontanelle may occur during the continuance of any considerable elevation of temperature, no matter what the cause. It has no diagnostic value, unless it occurs in an infant in whom one would expect to find a sunken condition of the fontanelle (see below), in which case its significance would correspond with that of an intense bulging fontanelle (see the following).

Tense and bulging fontanelle is due to an increase of pressure within the cavity of the skull. It may depend upon the existence of hydrocephalus, but there is only one way to determine this point absolutely, and that is by measurement.

If in addition to the tension and the bulging there are unmistakable evidences of suppuration going on, one is led to suspect the last stage of cerebral abscess, or, more commonly, purulent meningitis. Before the occurrence of this event, in the course of either of these diseases, the diagnosis may usually be made. Sometimes, however, abscess and meningitis are associated and a diagnosis has been difficult; then the more marked the cerebral symptoms and the neuritis, the greater is the probability of abscess.

In the newly born infant a tense, bulging fontanelle, with entire absence of all pulsation, is indicative of meningeal hemorrhage. The same would also hold true if the bulging was present without much tension, for the normal condition at this time is one of slight depression.

Sunken fontanelle is not of itself indicative of anything. However, accompanied by other signs, it may be part of the general picture observed in many cases of collapse. If the bones of the skull allow their edges to slide easily over each other, and

with this there is sunken fontanelle, it suggests two conditions —either simple atrophy or hydrocephaloid.

Murmuring.—If upon auscultation of the fontanelle a murmur can distinctly be heard, and that murmur is synchronous with the pulse, it is in nearly every instance due to anemia, and the fact that it occurs not uncommonly during rachitis is due to the fact that anemia is one of the features.

CRANIOTABES

Craniotabes are soft spots which appear in the occiput (common form), or may be a general softening of the whole bone without definite soft spots. The type accords with the severity of the cause, the spotted being the milder type. The cause is always one of two—rachitis or syphilis. The simplest and safest way to demonstrate them so that they will not be overlooked is to stand at the side of the recumbent child, facing it; then with the thumbs resting upon the forehead the bent fingers of both hands are swept over the whole of the occiput. Upon pressure the feel is as though parchment was being crushed.

In very rare instances they are present at birth, but disappear rapidly. The acquired form usually appears about the fourth month of life.

TUMORS OF THE HEAD

Tumors of the head occur with most frequency in the newly born infant.

Caput Succedaneum.—So common as almost to rank as a physiological process is the formation of a diffuse tumor of the head, appearing at or shortly following delivery. Such a tumor occupies the portion of the head which has been subject to the greatest or most prolonged pressure. It is doughy in its consistency and sufficiently edematous to pit slightly upon pressure. The margins are not clearly defined, there is absolutely no connection with any of the sutures, and the whole mass is of a bluish color. The skin covering the tumor may be bruised, and this is the one thing which adds to the importance of the tumor—the

possibility of infection. This eliminated, the tumor has no importance and the fluid content is usually absorbed within four days.

Cephalhematoma differs from the former by appearing two or three days after delivery. This tumor may be due to extravasation external to the skull, or the blood may be connected with an accumulation within the cranium. Although it is generally stated that it arises from the same causes as caput succedaneum, this is not true, for it is sometimes present in breech cases and in infants delivered by Cesarean section.

At first there may be a rather rapid increase in the size, then follows a period of quiescence lasting for several days, and finally a gradual subsidence, with complete disappearance within four to twelve weeks. To the touch the tumor is soft, elastic, and fluctuating. There may be double or even triple tumors.

The tumor is invariably limited in its extent by the borders of the bone over which it occurs; it is characteristic of it that it never crosses a suture. This very fact would differentiate it from a hernia cerebri, which always comes through at an opening or unprotected space.

The skin over a cephalhematoma is normal; and this helps to distinguish it from caput succedaneum, which is covered with bluish skin, crosses sutures and fontanelles, pits on pressure, and disappears early.

Meningocele, Encephalocele, Hydrencephalocele.—In common, all of these tumors have a smooth or lobulated surface and are protrusions of a portion of the cranial content through an opening in the skull. The first is a protrusion of a portion of the membranes of the brain; the second contains a portion of the brain substance; while the third contains brain substance and cerebrospinal fluid.

Meningocele is the rarest form of the three. The tumor is small at first, but increases in size; it is pediculated and has a smooth surface. Fluctuation is usually very distinct.

Encephalocele is usually small, rarely pediculated, and never has fluctuation as a feature, but there is distinct pulsation.

Hydrencephalocele is large and pendulous with a lobulated surface.

Pneumatocele Cranii.—A remarkable form of tumor is occasionally met with in infants. It is tense, well defined, and painless, and can be reduced by pressure. Usually it is congenital, but may appear in later life and without apparent cause. The usual situation is over the temporal bone. Strong expiratory efforts increase the size of the tumor. Puncture allows the escape of air, but the tumor soon refills.

EXAMINATION OF THE NOSE

The examination of the nose and the adjacent structures and cavities in the infant does not differ in any material way from a similar examination in the adult. In very young children there is a lack of coöperation which makes such an examination impossible or very unsatisfactory.

Pain about the Region of the Nose.—This may be described by an older child as of a smarting or burning character, and when located in the nose, is generally due to some acute catarrhal inflammation. In other instances it may be due to the impaction of a foreign body or to ulceration. When pain is more or less severe and referred to the parts just about the root of the nose, it is usually due to trouble in the frontal sinus. If pain is referred to the cheek or in the nose, and catarrhal inflammation is excluded in the nose, then it is suggestive of some affection of the antrum; if referred to the ear, it may be due to affection of the eustachian tubes, but all possibility of an ear affection must be excluded (a very difficult matter). The only safe way to diagnose a eustachian-tube disease is to observe the symptoms as they follow or are associated with disease of the nose.

Nasal Stenosis.—There is a difficulty in breathing through the nose in acute rhinitis, diphtheria of the nasal passages, when foreign bodies have been introduced (usually limited to one side), and in asthma. In all these the difficulty is of rapid development. When more gradually developed, nasal obstruction may be due to chronic rhinitis, growths within the nasal cavity, deviated septum, or syphilis.

Discharges from the Nose.—Discharges from the nose may be watery mucous, muco-purulent, or purulent, and without offensive odor; or the secretion may be offensive or bloody. However, for the purposes of diagnosis the best division is into acute and chronic discharges.

ACUTE NASAL DISCHARGE

Acute Rhinitis.—Rhinitis, whether acute or chronic, is one of the commonest disorders of early life. There are several predisposing causes which make the child particularly susceptible to it. Five such factors are more or less in evidence:

(*a*) The age: the younger the child, the less active need be the exciting cause of rhinitis.

(*b*) Lowered vitality, especially if dependent upon nutritional defect.

(*c*) Hereditary influences, including malformations of the nose.

(*d*) The presence of pathogenic bacteria.

(*e*) Exposure to atmospheric change, which is the least important of all the factors.

The disease in the acute form usually begins with an attack of sneezing, which is gradually followed by a sense of stuffiness in the head and a peculiar dry and irritable condition of the mucous membrane of the nose. Within a few hours there appears a profuse watery discharge, which, as a rule, is very irritating, producing redness or excoriation at the edge of the nostril and upon the skin over the lip. This may be followed by a mucopurulent discharge, some interference with the senses of smell and taste, and slight fever. Frequently the occlusion of the nasal passages is such that mouth-breathing becomes a necessity, resulting in a distressing dryness of the throat. This may lead to a secondary pharyngitis and laryngitis.

In nurslings the first evidence of the disease is usually given by the child attempting to nurse, leaving the breast with a cry, and immediately returning to the breast, only to have the same performance repeated all over again. This is occasioned by the fact that the occlusion of the nose interferes with free nursing and the child rebels.

The duration of the disease is from a few days to three weeks.

The diagnosis presents practically no difficulty. Where the difficulty is experienced is in assigning the cause. Especially inclined to attacks of acute rhinitis are those children who are brought up like hot-house plants, being more or less confined in overheated rooms. When a history is obtainable, as is most

frequently the case, it is that the child takes cold easily and that it always affects the nose, and under such conditions we are justified in suspecting that a chronic rhinitis exists, and that the acute attack is merely an exacerbation. It is very unusual to see the case so early that there is not some chronicity about the disease.

An acute rhinitis occurring in an infant a few days old, with a nasal discharge which is purulent from the start, should at once arouse a suspicion of gonorrheal infection. If, associated with it, there is a blennorrhagic conjunctivitis, the diagnosis is practically certain; but in the case of a reasonable doubt, recourse may be had to microscopic examination of the discharge. The denial of the occurrence of gonorrhea in either parent is of no value.

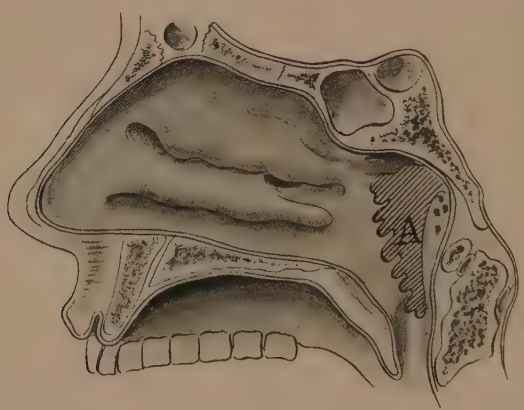

Fig. 17.—Diagram (anteroposterior) illustrating by the shaded portion (A) the situation of adenoid vegetations in the nasopharynx.

Acute rhinitis occurring with an associated catarrh of other organs is an evidence of the general ill health of the child. It occurs with almost uniform regularity in the preëruptive stage of rubeola, and at the onset of influenza, pertussis, and bronchitis.

Inhalations of irritating vapors or of certain chemicals (chlorin, bromin, hydrochloric acid) may produce an acute rhinitis, and saturation of the system with iodin often results in the disease, the discharge having a peculiar fetid odor.

Adenoid Vegetations.—It is very common to find that this is the cause of the occasional attacks of acute rhinitis, and the

condition is more apt to be evidenced in this form than in the form of a chronic rhinitis. Chronic rhinitis may be present, but it is not self-evident, the careful taking of a history being necessary to bring the fact out.

Adenoids may be present so that they can be appreciated as early as the second month of life. This is unusual, however, for the time at which they are most in evidence is between the third and the fifth years. It is so frequently the case that enlarged tonsils are associated with adenoids that the presence of one should lead to a suspicion of the presence of the other. The symptoms are usually quite typical. Certainly after observing a number of cases one is usually able to diagnose the condition by the appearance of the child alone. I am not advocating this method of diagnosis, however, but simply stating what is a fact. A thorough examination should be made in every suspected case.

Fig. 18.—A characteristic pose of child with adenoid vegetations.

The facial expression is quite characteristic; it is somewhat dull, and the open mouth, the thickened lips, the absence of the groove over the alæ nasi, the pinched appearance of the nose, and the prominent transverse vein at the root of the nose complete a picture which is simulated by no other condition. There is an inability to blow the nose when the growth is large, and as a result the nostrils are obstructed by mucus. The voice assumes a nasal twang in many cases.

When the history is taken, it reveals the fact that the child is very restless at night and takes cold very readily. If the adenoids have been long present, there is more or less abundant evidence

of stunted physical and mental development. Reflexes are as varied as is the susceptibility of children to certain impressions. Some of these reflexes are epistaxis, incontinence of urine, cough, muscular spasms, muscular twitchings, stammering, sudden and transient deafness, etc. Deafness of a permanent nature is sometimes an associated condition.

The examination is so simple that it is a wonder that it is not more commonly practised. Upon an inspection of the mouth it is found that the hard palate is more arched than normal, and that the secondary teeth are irregular and inclined to project. When the tongue is depressed, the posterior pharyngeal wall is observed to be covered with a thick white mucus which flows down from the nasopharynx.

Fig. 19.—Adenoid vegetations, front view of same child as in figure 18.

An examination should then be made of the nasopharynx. To accomplish this, the examiner takes a position behind and somewhat to the right of the child, who is seated upon a chair, or, better still, held firmly upon the mother's knee. The left hand of the examiner firmly restrains the head by pressing it against the left side of the examiner's body. When the child's mouth has been opened, the left cheek is forced by one finger of the left hand into the mouth and between the teeth, thus preventing closure of the mouth. The examining finger is then carried rapidly into the mouth and turned upward to the nasopharynx, being carried back of the soft palate into the nasopharyngeal cavity.

If adenoids are present, instead of the thin mucous membrane normally covering the bony structures, one encounters a soft

mass, the feel of which is not unlike that of a mass of worms. When the finger is withdrawn, it is generally found to be covered with blood and tenacious mucus. I must emphasize the fact, however, that the presence of blood on the finger has no distinctive diagnostic value; its absence does not exclude adenoids.

Adenoids might be mistaken for a polypus, but the chance of such an error is so slight when an examination of the nasopharyngeal cavity is made by the finger that it need not be considered.

Membranous Rhinitis.—This is an acute inflammation of the nasal mucous membrane accompanied by the formation of a membrane. The membrane is grayish-white, and if removed early in the disease, it leaves a raw and bleeding surface. More or less marked obstruction of the nose is usually the first symptom, but this results in mouth-breathing with its long train of consequent symptoms. One peculiarity of the nasal discharge is that it is scarcely irritating, and this serves to distinguish it early from acute rhinitis. The examination shows that one or both nostrils are filled with a tenacious mucus, and its presence should lead to a thorough cleansing of the nose and a search for membrane.

Frequently there is some difficulty in examining the nares of a child, and if the tenacious mucus filling the nostrils (which has been described) is present, the administration of a few drops of chloroform or ethyl bromid is justifiable. After dilating with a nasal speculum, the nostrils are cleansed, and then the extent and situation of the membrane can easily be determined. Care must be exercised to determine the presence of a foreign body, for often this is the cause of the formation of a membrane. With a pair of small forceps the tenacity of the membrane is tested, but the whole procedure must be gently done. Late in the disease the membrane is removed without any bleeding and with little effort; early in the disease more force is required and there is some bleeding.

First of all, we must exclude the effect of the use of a caustic in the nose, the introduction of a foreign body, and an injury; and when that is done, then the diagnosis will rest between this form of rhinitis and nasal diphtheria. In the latter the discharge is early tinged with blood, although the amount may be very small.

The glands of the neck are somewhat enlarged and tender and there is apt to be more or less fever.

Associated with the nasal condition, there is usually evidence of the disease in the tonsils, the pillars of the fauces, or in the naso-pharynx. The discharge is irritating to the parts it touches. In membranous rhinitis the discharge is not irritating to the skin and is not blood-tinged unless some violence has been used. The temperature is normal, as a rule. Despite the fact that the diagnosis is usually easily made from the symptoms alone, a culture should be made in every case and the presence or absence of the Klebs-Loeffler bacillus determined.

CHRONIC RHINITIS

It may be a very difficult matter to distinguish between a mild chronic rhinitis and a continued series of acute attacks. This is complicated further by the fact that in the same child the character of the discharge may not be a constant feature. In a general way the chronic attacks differ from the acute in the absence of fever, by the prolonged course, and that while the discharge is usually more abundant, the swelling and the redness are much less pronounced.

Undoubtedly most of the cases are produced in older children by improper breathing and from retained secretion due to the presence of adenoids.

Hereditary Syphilis.—By far the most important bearing which chronic rhinitis has upon diagnosis is its occurrence in the infant. The only evidence of hereditary syphilis which we may have for a long time in the newly born is "snuffles." This may occur at times without nasal discharge, but usually there is a discharge of mucus, which is occasionally tinged with blood. In rarer instances there is epistaxis. Occasionally a child is born with the secondary manifestations of syphilis, but the rule is for them to appear later (that is, from the second to the sixth week, or at the third month).

The infant experiences much difficulty in nursing, as the occlusion of the nose is usually complete. When the discharge occurs, it is generally continuous. The characteristic thing about syphilitic

rhinitis is its persistent chronicity. Such infants become rapidly emaciated, and with the wrinkling of the skin, they have a peculiarly old look. The suspicion once aroused, examination should be made of the whole body, and evidences of the disease will almost invariably be discovered.

Atrophic Rhinitis.—This is a chronic inflammation of the mucous membrane of the nose which results in an atrophy of the membrane and the turbinal bones. It is rare in children.

The local symptoms are nasal occlusion by the presence of crusts, which the child removes several times daily. The odor from these crusts is fetid and is imparted to the breath. When the atrophic changes take place, which they do insidiously, attention may be first attracted to the condition by the ozena. As the disease reaches the atrophic stage, dryness of the nose, of the pharynx, and of the larynx becomes the prominent feature. This is very noticeable in the mornings, producing the well-known hawking.

Both posterior and anterior rhinoscopy reveal the presence of thick greenish or black crusts, adherent to the turbinate and septum mucous membranes and over the pharyngeal wall. The mucous membranes are dry, glistening, and swollen, and there may be ulcerated areas where the crusts have been dislodged.

Foreign Body in the Nose.—This is met with as soon as the infant is able to get about the floor, and it is remarkable sometimes to observe the persistency with which some children will continue to place articles in the nostrils. Sometimes the habit is acquired of placing articles in the mouth, and these are swallowed and later vomited, and may lodge in the posterior nares. They act as sources of irritation and may result in ulceration. When the latter takes place, the discharge may become more or less fetid and irritating.

Usually it is impossible to tell from the symptoms that a foreign body is present, for they so closely resemble those of acute rhinitis or even nasal diphtheria. The most characteristic symptoms are pain in the ear corresponding with the side on which the foreign body is located, unilateral discharge, and snoring which is suddenly developed in a child who previously rested easily.

A positive diagnosis cannot be made without an examination of the nose, and if necessary, this should be done under primary anesthesia. Recently introduced articles will usually be found upon the floor of the nose, between the septum and the inferior turbinate. Later, the article may be forced further back. The examination entails that the nose be thoroughly cleansed before the search is instituted.

Nasal Polypi.—These are rare during childhood. When present, the symptoms are of nasal obstruction associated with various reflexes. The amount of obstruction depends upon the size and number of the growths, sometimes one and at other times both nostrils being partly or completely occluded. Frontal headache is common. There is a quite constant discharge of a secretion which looks like the white of an egg, and if the growths are large or numerous, the voice assumes a nasal twang, which is quite characteristic. During damp weather the obstruction is increased, and with the advent of dry weather all the symptoms improve.

The growths are sometimes large enough to be seen without a speculum. When the speculum is used, large polypi may be observed through the dilated nostril, and they usually lie between the septum and the outer wall of the nose. When small, they lie between the middle turbinate and the outer wall, or are attached to it. They resemble an oyster in color, and with the probe they are found to be freely movable and apparently without sensation. The probe may be passed freely about the growth, except at the point of its attachment.

All other tumors in the nose are firmer and harder than polypi. The distinctive features of a polypus are its full, smooth surface, its mobility, lack of sensitiveness, its slow growth, and the freedom with which it may be interfered with without occasioning bleeding.

EPISTAXIS

Usually the occurrence of epistaxis is readily recognized, because, as a rule, the blood flows more or less freely from the anterior nares. But it is not uncommon to find when the hemorrhage has been small that the blood does not flow from the

nostrils, but remains there until clotted, and is discharged in that form later; or there may be a clot noticed upon the posterior pharyngeal wall. In still other instances there will be no history of nose-bleed, but simply of the vomiting of blood. With such a history a thorough investigation must be made to determine the source of the hemorrhage, for it frequently occurs that a child will have a profuse hemorrhage from the nose while it is in the prone position, and the blood is swallowed and subsequently vomited. The alarm of the patient or its friends is then so great that no mention is made of any conditions within the nasopharynx which might account for the presence of the blood.

In epistaxis the bleeding is generally capillary. If there is no history of traumatism, it is best to first examine the septum, for this is the most frequent site of hemorrhage; then the vault of the pharynx should be investigated. On wiping away the blood there will usually be found a bleeding point from which there is more or less oozing. If the hemorrhage is a recent one, a clot will be present; if more remote, there may be a dry, brownish or black crust, the removal of which generally results in fresh oozing. If the site of the hemorrhage is not found to be either of the parts which have been mentioned, then it will be a difficult matter to find the source.

The causes of epistaxis are quite numerous, and may be divided into those which are general and those which are local.

General Causes.—All conditions which favor congestion may influence the occurrence of epistaxis. Then there are various blood conditions which favor it, as hemophilia, purpura, scurvy, anemia, chlorosis, leukemia, syphilis, and rheumatism.

In an otherwise healthy child, if epistaxis repeatedly occurs and the cause is undiscoverable, the strong probability is that it is dependent upon rheumatism. Very commonly a carefully taken history will reveal the fact that the child has been the subject of indefinite pain which has not been severe enough to attract attention. An examination of the urine will at once reveal its turbidity and the presence of abundant uric acid salts. The further examination may reveal some chronic cardiac disease which has escaped attention up to this time.

Epistaxis may occur as an accompaniment of many acute

diseases, and especially those of an infectious nature, but in this connection it has no special significance. During the course of nasal diphtheria it is usually of late occurrence, but, late as it may be, it is frequently the first symptom to attract attention to the situation of the membrane in the nose.

It is not uncommon for epistaxis to occur in cardiac disease, and especially under those conditions in which there is increased arterial tension or a hindered return flow of the blood. If the bleeding occurs immediately after a severe coughing spell, it is strongly indicative of pertussis.

When the cause of an epistaxis has been systematically searched for, and still remains obscure, it should arouse suspicion of a weakened heart action from some cause, probably organic. Periodical epistaxis is not uncommon, and in nearly every instance may be traced to malaria.

There seems to be a strong predisposition in some children to the occurrence of nose-bleed; the slightest causes are sufficient to start in them a profuse epistaxis, despite the fact that they remain in perfect health, and that there is no evidence of any hemorrhagic tendency which is hereditary.

Local Causes.—Under local causes traumatism is by far the most common, such as falls and blows upon the nose. In some children on the cartilaginous part of the septum there is a small group of thin-walled veins, and a blow or picking at this part of the nose may readily excite hemorrhage. Under certain conditions, as congestion or rheumatism, even the blowing of the nose may cause epistaxis, the blood coming from this point.

Aside from what is strictly trauma, the presence of a foreign body in the nose may excite profuse hemorrhage. Some children have a strong disposition to push small articles into their nostrils. During acute rhinitis a small amount of nose-bleed may occur, but it is not frequent.

Other factors in the causation are ulcerations, varicosities, and severe catarrhal inflammations. New-growths may be accompanied by epistaxis. Violent exercise and excessive study have been assigned as causes of nose-bleed, but they are active only in children who are generally debilitated.

EXAMINATION OF THE LIPS, TONGUE, AND MOUTH

MALFORMATIONS

Harelip is one of the most frequent of the congenital deformities, and may be single or double. The fissure is generally situated just under the center of the nostril, and not in the median line. It extends in nearly every instance up to the nostril. In some of the cases there is simply an indentation in the lip.

Cleft Palate.—It is somewhat unusual for harelip to occur without being associated with cleft palate. This is due to an imperfect closure of the fetal gap in this region. In contrast to harelip, cleft palate is in the median line and involves the soft palate and the uvula in many cases. If the cleft in the hard palate includes the alveolar border, it may leave the median line.

Both harelip and cleft palate interfere seriously with nutrition.

Hypertrophy of the tongue should be looked upon as a lymphangioma. The tongue may be considerably swollen, so that it fills the mouth and may even protrude from it. Naturally, it interferes with perfect nursing, swallowing, and respiration.

Tongue-tie is simply due to a congenital shortness of the frenum of the tongue and exists in all degrees. It may interfere with the protrusion of the tongue, or with its free use so as to interfere with nursing.

Bifid uvula may be associated with cleft palate or may exist alone, and is not an infrequent condition, although marked degrees of bifurcation are somewhat rare.

Bifid tongue is exceedingly rare.

THE LIPS

Thick or thin lips are a racial characteristic, and in this connection are of no value in diagnosis. But, on the other hand, a thickened lip may be part of the facies of cretinism, and the scrofulous diathesis may be indicated, in part, by a much thickened upper lip without any evidences of inflammation.

Color of the Lips.—They are pale in anemia and cyanotic when the heart is acutely weak or there is much obstruction to respiration. They may become pale as the first indication of syncope. If upon exertion the lips of a child become bluish in color, it is strongly indicative of some cardiac disease.

Unilateral deviation is in most cases attributable to the loss of some of the teeth or to their marked loosening; or cicatrices may be responsible for the deformity. With these two excluded, it is indicative of facial paralysis.

Open lips, especially if there is an associated blueness, are suggestive of interference with nasal breathing, or of the presence of dyspnea. Open lips are part of the picture seen in prostration and collapse.

If, in addition to being parted, the lips are loose and pendulous, it is indicative of paralysis, especially the post-diphtheritic form. In idiocy the lips are open and the lower lip is pendulous and loose, but this is a chronic condition and associated with other signs.

In acute cases the lips may be open, with saliva dripping from the corners of the mouth, and this would lead one to suspect some condition within the mouth, as stomatitis. Mouth-breathers habitually keep the lips parted.

Swollen lips are usually due to the bites of insects, but may also be due to local lesions of the mucosa from long-continued irritation. Cancrum oris especially is apt to cause a swelling of the lips. Primary swelling is not a usual occurrence, but secondary swelling is not uncommon (following or associated with perlèche, cancrum oris, injury during convulsions, etc.).

Twitching may be due to chorea, or if occurring while the infant is asleep, may be the first indication of the threatened onset of general convulsions. Under any circumstances it indicates an irritation of the nervous system. A convulsive contraction of the upper lip is quite indicative of abdominal pain.

Eruptions About the Lips

Herpes.—The lips are very frequently the site of the development of several small vesicles which occur in groups or clusters, finally rupturing and forming small crusts or scabs. These are

called herpes, and are known to the laity as "fever blisters" or "cold sores." The condition is very apt to occur during any catarrhal inflammation of the respiratory tract and malaria. Its common occurrence during pneumonia and epidemic meningitis gives to it a position of some diagnostic value. It never occurs during typhoid fever or tuberculous meningitis, so that this fact may be of much value in differentiation.

Perlèche is an infectious disease of the lips, which is first evidenced by the lips becoming hot and swollen. This is accompanied by some itching and smarting, which causes the child to constantly lick the site of the trouble (the corners of the lips). Fissures quickly form in the mucous membrane, and these become worse with the constant irritation of the licking. The mucous membrane soon becomes macerated, thickened, and opaque, and comes off in patches and stripes. The disease lasts for about three weeks.

The chief interest is in its differentiation from herpes and eczema, either of which may be associated with it. The swelling in perlèche is greater than in herpes, and there are smarting and itching. From eczema the diagnosis is difficult at first, but the effect of treatment soon clears away any doubt. The constant desire to lick is a strong point in favor of perlèche.

Eczema may affect the corners of the mouth or the border of the lips, resulting in fissures or cracks which are quite painful and bleed easily. Usually there are other associated lesions in remote parts.

THE TONGUE

The examination of the infant's tongue is best made at the same time that the throat is examined, for what little information we obtain from its inspection is valueless if only the tip is observed. The laity lay great stress upon the value of such an examination, but the diagnostic value of an inspection is very much overestimated.

Coated Tongue.—It has been taught and re-taught that the condition of the gastro-intestinal tract was clearly reflected in the condition of the tongue's mucosa, and this is not so. Strictly speaking, the covering of the tongue is not mucous membrane, for embryonically it had its origin in the outer layer of the blasto-

derm, and is therefore a modified epithelium. Clinically it acts more like the skin than like mucous membrane.

A coated tongue is the usual accompaniment of all febrile conditions. It is a perfectly normal condition in many children who are absolutely healthy.

A dark-brown coating over the tongue may be seen in some cases of chronic indigestion, and the tongue has the appearance of being covered with fine black hairs; the diagnostic value of such an appearance, however, is *nil.* It is only necessary to remember its occasional occurrence, so that one may distinguish it from the black-stained tongue which is seen after the ingestion of certain drugs or foods. A more rare condition, which might be mistaken for it, is the formation of dark-brown crusts on the tongue in some cases of typhoid fever.

Any coating of the tongue becomes more pronounced under any or all of the following conditions:

(*a*) Immobility of the tongue, which prevents the cleansing which usually goes on, from constant activity.

(*b*) The presence of fever, which dries up the normal secretions of the mouth.

(*c*) The ingestion of certain drugs which reduce the flow of saliva.

(*d*) Inflammations of the mouth, or other conditions which result in lessened secretion of saliva or its immediate expulsion from the mouth.

The manner in which a coating clears is of much greater diagnostic value than the presence of the coating itself. In typhoid fever the tongue clears from the margins and the tip, and soon the anterior half of the tongue is clear in a triangular shape, with the apex toward the base of the tongue. In a condition that might be mistaken for typhoid the coating is always uniform, and when it clears it does so uniformly.

The "strawberry tongue" of scarlet fever is not of itself of much diagnostic value; it is not typical, and its occurrence is late (second or third day). Of just as great value is the manner of its clearing. The tongue is gradually coated up to the third or perhaps the fourth day; then it begins to clear, first at the tip and the margins, and within thirty-six or forty-eight hours it is

entirely clear and of a bright red color, with the papillæ much enlarged.

Dry, glazed tongue is seen in those cases of dysentery which run a protracted course, and is indicative of the generally weakened condition of the child. The same kind of a tongue may occasionally be observed in acute enteritis and during the course of intestinal obstruction, and in either case is of ill import.

Color of the Tongue.—This may depend upon the ingestion of certain foods, especially berries, or upon the local action of drugs. The poisons which are most commonly ingested by children give the following characteristic colors to the tongue, but reliance must not be placed upon these alone; they are merely corroborative evidences:

Corrosive sublimate: the tongue is white and shriveled, with the papillæ at the base very much enlarged.

Sulphuric acid: it is first white, then turns gray, and finally exhibits a black slough.

Phenol: the mucous membrane is shriveled into folds with brown or white spots appearing wherever the acid has touched. Within a few hours there appears a bright red zone about these spots and the color of the spot changes to a black.

Oxalic acid: the tongue looks scalded, but in addition there is a thick whitish coating.

Inflammation of the tongue is rare in childhood, but still may be occasioned by a sharp tooth or a bite received during a convulsion or a fall. The color is intensely red, but associated with it is much swelling.

(For redness of the tongue see the following section.)

Eruptions of variola, rubeola, and erysipelas may be seen on the tongue.

Diseases of the Tongue

Hypertrophy of the Tongue.—Aside from the congenital hypertrophy which has already been referred to, macroglossia may exist because of an increase of any or of all of the constituents of the tongue.

There may be either muscular or fibrous hypertrophy, cystic degeneration, or overdistention of the lymph-spaces with resultant cavernous lymphangioma. Hypertrophy of the lymphoid bodies

may cause lymphadenoma. No matter what the cause, the tongue may become too large for the mouth, and in severe cases protrusion will take place. When the condition is mild or just starting, the swelling of the tongue may force it against the teeth, and so result in injury to its membranous covering, this increasing the swelling. Even with a somewhat moderate enlargement, saliva dribbles from the mouth, and the ulcerations from injury produce an odor which is quite offensive.

The condition is disgusting alike to patient and attendant, and is fortunately rare.

Ulcers (other than those associated with disease of the mouth). —An ulcer on the tongue, and especially upon its under surface, is frequently due to the irritation caused by the eruption of a new tooth, or to injury caused by a ragged tooth.

When the lower median incisors are sharp or ragged, any severe attack of coughing may be the means of producing an ulceration of the tongue or of its frenum. Two conditions are necessary: severe coughing and sharp-edged incisors.

In nurslings coagulated milk may gather in spots upon the tongue and simulate ulcers. Their removal with a piece of cotton clears up all doubt as to their nature.

Epithelial desquamation of the tongue takes place in desquamative glossitis. (Such a condition is sometimes called lingua geographica.) The upper surface of the tongue is the part affected. The tongue exhibits several pale-pink islets about the size of a pea, where the epithelium has been denuded. These are surrounded by white circular zones of elongated filiform papillæ. The favorite situation for these islets is along the margin of the organ. The shape of the islets is not constant; they increase somewhat in size, and as the edges of the whitish zones coalesce, there is a disappearance of the white color at the point of union, so that finally the tongue has the appearance of being marked with twisted lines. Hence the term, "geographical tongue." After a few days the whole tongue clears and there is a rapid return to normal.

After the trouble has apparently subsided for several days there may be a fresh invasion, with the same process repeated, and this may continue almost indefinitely, so that the condition

may persist for months. During all this time there is little or no discomfort to the child. It may occur in children of any age, and irrespective of whether they are sick or well.

This condition bears no relation to any other disease, has little clinical significance, and is probably due to some microörganisms, the nature of which are still unknown.

Acute glossitis is a rare disease among children, yet it may arise under the influence of traumatism, bites of insects, etc., to which infection is added.

After a short period of soreness of the organ there are added stiffness and considerable pain upon motion of the member, and pain may also be referred to the muscles of the neck and jaw. Following this, the tongue rapidly enlarges, so that within twelve hours it is twice or three times the natural size. When this stage is reached, the tongue protrudes from the mouth and is almost immobile. Saliva constantly dribbles from the mouth and the tongue is heavily coated; dysphagia is extreme and speech impossible. The glands beneath the jaw may be much swollen and the temperature is raised slightly (about 101° F.).

Gangrene is the rule if the little one survives the threatened suffocation; but if neither happens during the first three days, the chances of resolution taking place are excellent, and within one week the normal condition is regained.

The diagnosis must be made from acute edematous swelling due to affections of the floor of the mouth, and from acute ranula, which sometimes causes considerable swelling of the tongue. In either case this is done by searching the floor of the mouth for the primary lesion.

DISEASES OF THE MOUTH

Practically all the diseases of the mouth are the result of trauma or of infection. The cavity is certainly an ideal breeding-place for all kinds of organisms, and it is only by the action of the secretions and the constant cleansing which normally goes on that disease is not more common. Probably the secretions act more emphatically in preventing disease than we are aware of, for clinically it is a fact that with diminished secretion, or in the presence of conditions which disturb the composition of that secretion, diseases of the mouth are more prevalent.

Diseases Unaccompanied by Odor or Ulceration

Gonorrheal Stomatitis.—This disease is only liable to occur when there has been an injury to the mouth which has removed the epithelium. Subsequent exposure may produce it, but this is unusual. Yellowish-white patches are formed on the tongue and the hard palate and the gonococcus is found in the exudate. There is but little inflammation and tenderness, so that, further than a mild remonstrance at first, the infant does not object to being placed at the breast. It is very rare that the condition exists alone in the mouth, but it is generally associated with other evidences of gonorrheal infection.

Acute Catarrhal Stomatitis.—This is the commonest affection of the mouth during infancy. It is a part of, or precedes, nearly all other forms of stomatitis. It may evidence itself by a general hyperemia and hypersensitiveness of the membranes, or there may be considerable inflammation with pain, tenderness, and increased secretion.

The usual course in infancy is at first a reddening of the membranes of the tongue and gums (sometimes of all of the mucous membrane of the mouth). Salivation is invariably present and the secretion may be so acid that the lip becomes inflamed. The tongue has a white, furry coating which becomes gradually darker, then disappears piecemeal.

The infant refuses to nurse after several attempts have been made to do so. The general symptoms are restlessness, slight rise of temperature, and possibly diarrhea of a mild type.

In older children, in whom the disease is much less frequent, there may be added to the usual symptoms of pain, salivation, fever, and coated tongue, a decided swelling of the tongue, with indentures along its side from pressure against the teeth. If any odor is present, it is very faint and never disagreeable. When present, it is worse in the morning and is readily removed by washing out the mouth.

This type of stomatitis arises from various causes: retention of particles of food in the mouth may result in their decomposition, and the irritation caused thereby may be the starting-point for the invasion of microörganisms. If the child happens to be in a state of malnutrition or poor health, or there is any factor which

diminishes the flow of saliva, the growth of bacteria is favored. When they once gain a foothold, the products of the inflammation tend strongly to produce or invite secondary infections.

Certain drugs, used either locally or internally, may produce it (acids, mercury, strong alkalis, etc.).

Stomatitis Mycosa (Thrush, Sprue, etc.).—This is a parasitic form of stomatitis. The spores of this causative fungus may be found in the mouth of the healthy infant, and in fact they are everywhere prevalent. All that is needed for their development is the favorable soil, and this may be produced by simple neglect of the mouth. Finding suitable soil, they multiply until they appear upon the surface of the mucosa of the tongue, the posterior surface of the lips and of the cheeks and gums, in the form of small white flakes. In some instances there is an extension of the disease into the throat and esophagus.

The flakes are entirely white, and at first are firmly attached to the surface, so that forcible removal leaves an abraded and perhaps a slightly bleeding surface. Later in the disease they separate from the surface spontaneously. Immediately around each spot the mucosa looks drier than normal. When neglected, several of these spots may coalesce. The disease is of itself painless, but the accompanying catarrhal stomatitis may cause considerable distress.

This is essentially a disease of the first weeks of life, and while it may develop in children who have passed the early suckling period, it is then associated with other disease which has exhausted the system. Occurring under these circumstances it is a late happening and a serious one.

The diagnosis is made by the mode of development and the nature of the spots, whose chief and constant characteristic is their entirely white color and difficult removal early in the disease.

The general symptoms are those of the inflammation, and added to these or modifying them are the symptoms of the associated disease.

Diseases with Ulceration and no Offensive Odor

Stomatitis Aphthosa (Canker; Sore-mouth).—This is characterized by the formation upon the mucous membrane of the

tongue, cheeks, and lips of small, shallow, rounded ulcers which usually appear in successive crops. Sometimes the first appearance is of a solitary vesicular lesion upon the tonsil. It does not take long for the eruption to develop, for usually within twenty-four hours it has spread well over the parts. At first the ulcers are about one-eighth of an inch in diameter and covered with a yellowish exudate. The ulcers rapidly coalesce, forming large patches which may resemble a diphtheritic exudate. As the ulcer ages it assumes a dirty grayish color, or may be of a dirty yellowish hue, but in either case surrounded by a reddened zone.

Salivation is excessive and excoriation of the lips and chin is the rule. One of the characteristics of this type of ulceration is the entire absence of fetid breath. Another is its common occurrence at the time of the first teething.

The general symptoms are much the same as in the catarrhal form, but much intensified. Pain is much more of a feature in this form than in the simple catarrhal form. The duration of the disease is between one and two weeks.

In diagnosis a distinction has to be made between this disease and ulcerative or diphtheritic stomatitis, as well as from the lesions of variola and varicella as they appear in the mouth. The situation of the ulcers and the entire absence of fetor will exclude ulcerative stomatitis. The early appearance of salivation and the early disappearance of the coalesced patches tend to prove the non-diphtheritic nature of the disease. The history of contagion and the generally severe character of the initial symptoms of variola would help to differentiate it, while from varicella the distinction would be very difficult, and one might have to wait until the true nature of the disease was exposed by the subsequent skin eruption.

Syphilitic Stomatitis.—This is most frequently observed during the relapses. There are patches formed which are whitish and slightly elevated, with a papillary structure, and this feature is usually so decided that one may see several thickly crowded papillæ tops forming the patch. They are situated upon the mucous membrane of the mouth, especially at the angles, and upon the lips, tongue, soft palate, and tonsils. Fissures of the lips and of the angles of the mouth are more distinctive of hered-

itary syphilis when they occur during the first weeks of life; later than that they may appear without syphilis being the cause, and then they are usually the result of fever.

Aphthæ of the palate usually appears as a double lesion of the mucous membrane, but on opposite sides of the mouth where the hard and soft palates join. The ulcers are generally symmetrically located and are superficial and circular. They are of a grayish-yellow hue.

They are in evidence for about three weeks and then gradually disappear. In abortive children they may spread and the two lesions may coalesce and others be formed, and under these circumstances the duration of the affection is from six to eight weeks.

The condition is peculiar to the first few weeks of life.

Diseases with Ulceration and Offensive Odor

In this class of cases it is first necessary to determine the source of the odor, for even in the presence of ulceration within the mouth the odor may depend upon some associated condition and be entirely distinct from the ulceration.

When the tongue is considerably coated, there is apt to be more or less disagreeable odor, which is readily removed by mouth-washing. A decayed tooth or the presence of decaying food in the mouth will give rise to some odor, but washing removes the smell, for a time at least, and in any instance, while the odor may be unpleasant, it is not offensive. Rhinitis is one of the most frequent sources of odor, and this can be distinguished from other causes by the fact that it is most noticeable during expiration through the nose.

Other causes of offensive odor may be catarrh of the stomach with eructations of foul-smelling gas, bronchiectasiæ with fetid contents, and gangrene of the lung.

Stomatitis Ulcerosa.—This condition may develop at any time of life, but is very unusual before the eruption of the teeth and after the ninth year. It depends largely upon a depraved condition of the general nutritive processes, and in rare instances may be directly traceable to metallic poisons, especially mercury and lead. During scorbutus it is by no means uncommon.

The lesions may occur upon any part of the mucous membrane of the mouth, but usually the very first point of invasion is at the junction of the tooth and gum. The intense, offensive odor of the mouth is generally the first thing noticed, then the ulceration is discovered. This is shortly followed by swelling of the gums, and they become intensely congested and somewhat friable, bleeding readily from slight pressure. The margins of the gum rise toward the crown of the tooth both internally and externally. The disease may continue until the soft and congested gum falls away from the tooth and pus forms in the intervening spaces or burrows through the alveolar process. Then two things may occur: the teeth become loosened and fall out, or the jaw may become necrotic.

The ulcerative process may spread to the buccal mucosa, so that there is soon formed an ulcerated strip of a dirty yellow color, which soon breaks down, leaving an open ulceration with a foul bottom and undermined and broken edges. Associated with this, the whole cheek may be greatly swollen and the submaxillary glands enlarged. The tongue may be swollen and indented from the teeth. The general symptoms are unusually mild, unless sepsis occurs.

Stomatitis Gangrænosa (Noma).—This is the most severe type of stomatitis as it occurs in childhood, and is fortunately not common. The time at which it is most likely to occur is during the interval between the first and second dentition. It is usually preceded by a catarrhal stomatitis which occurs in a child whose general nutrition and vitality are not up to standard.

The gangrenous odor of the mouth is usually the first thing noticed, and then the ulcer is discovered. In the commencement the ulcer is a small spot of inflammation which appears upon the cheek, usually after two days of indefinite illness (slight fever, tender submaxillary and cervical glands, salivation). This red spot of inflammation rapidly deepens in color, so that it may soon become blue, purple, or black, and it rapidly increases in area as the necrosis spreads over the face. The destruction of tissue is rapid and very wide-spread, and if the unusual occurrence of spontaneous resolution takes place, the child is terribly deformed

by the cicatrix. The general symptoms are severe and the cases usually result in early death.

The diagnosis is made from anthrax by the history and the character of the ulcer; in anthrax there is at first a small pustule, which is rapidly formed into a solid but odorless scab, surrounded by new pustules or vesicles, and then only does a tumor of the soft parts appear.

Diseases with Formation of Membrane

Stomatitis Membranosa.—A pseudomembrane may form in the mouth and upon the lips during the course of the acute infectious fevers or as the result of irritants. These membranes are generally due to bacterial growth, and may be the forward extension of a croupous angina.

In very rare instances the condition seems to be primary. There is at times a very considerable systemic disturbance. The membranes may assume a darker color from exposure to the air, and this is especially true if any hemorrhage has taken place from fissures in the mucosa. Under treatment or with the exercise of ordinary cleanliness the membranes gradually disappear, leaving the mucous membrane somewhat reddened and denuded of epithelium.

The diagnosis from diphtheria depends entirely upon the absence of the Klebs-Loeffler bacilli. From stomatitis mycosa the diagnosis is made by the absence of the characteristic thrush fungus.

THE FAUCES AND PHARYNX

Between the mouth and the respiratory organs there is a passage which is lined with mucous membrane, and this is subject to the diseases which are common to all mucous membranes. Its situation makes it particularly liable to secondary diseases, while, upon the other hand, affections of the pharynx bear but little relation, diagnostically, to disease in other parts.

For example, one could mention many instances like this: Tonsillitis occurs, and at once we are aware that it may be a manifestation of a general condition of rheumatism. But when we endeavor to name the general affections which can be diagnosed by the appearance of the pharynx, we find that we are limited to just one—rubeola.

The general symptoms of pharyngeal disease are certainly not marked, and it is absolutely essential that at every opportunity the pharynx should be examined. With the exception of diphtheria, erysipelas, retropharyngeal lymphadenitis, and tonsillitis, general symptoms are mild, but in these four they are often out of all proportion to the local condition.

Pain is more or less constant in affections of the fauces and pharynx, because the functional acts require the use of all of the structures, and when there is ulceration or inflammation of a marked degree, movement causes pain.

Odor of the breath and dysphagia are discussed in other sections (see pages 69 and 96).

The Examination.—The examination of the fauces in children should be left as late in the general examination as possible, for after the throat has once been examined, the child is almost certain to rebel at any further interference, no matter how slight its character. The tongue and the uvula offer difficulties in examination.

There is nothing quite so annoying as the attempt to examine the throat of a struggling child whose wilfullness is uncontrolled

by the parent. The most satisfactory method is to have the attendant hold the child in the lap, facing the best obtainable light. Then she should be told to hold the child firmly against her side in a sitting position, while the arm that encircles the body confines the child's arms also, with a total disregard of the position of the child's head.

Then, while so held firmly, the examiner with one hand presses the child's head against his side, at the same time and with the same hand forcing the cheek in between the teeth, so that the mouth cannot be closed until the examination is complete. With the free hand the tongue depressor is used and the fauces inspected.

If the child is coöperating with the examiner, the instruction to endeavor to say "ah" will cause the posterior pharyngeal wall to be brought more prominently into view. The same thing is accomplished to an extent in a child who will not coöperate, by passing the tongue depressor backward until gagging is produced.

Fig. 20.—Illustrating a very good and common position for throat examination.

The normal condition is as follows: The color is of a dark red, and the posterior pharyngeal wall shows little elevations (glands) upon its surface with visible but moderately sized vessels coursing through the mucous membrane. The tonsils are small and ordinary inspection reveals their whole surface. The uvula hangs midway from the palate and has a rounded end. There is an oval depression in each tonsil with its longest diameter perpendicular.

DISEASES OF THE FAUCES AND THE PHARYNX

Acute Tonsillitis.—Acute inflammation of the tonsils may be limited to the mucous membrane, when it is known as simple catarrhal tonsillitis; or it may affect the follicles, constituting follicular tonsillitis. If the inflammation extends to the stroma of the gland, suppuration results, and we have suppurative tonsillitis. A peculiarity of all the acute forms is their liability to recur in the same individual.

Simple Catarrhal Tonsillitis.—This is the most common form among children and is of importance because it leaves the child liable to the later development of other infections, which are favored by the lowered vitality and the abnormal condition of the gland. It is at times epidemic, may accompany any of the acute infectious diseases, and is precipitated by exposure to dampness or cold.

The mucous membrane is swollen and congested. The gland does not show any marked enlargement, unless there is a chronic condition of enlargement present. If the case is moderately severe, the upper deep cervical glands may be enlarged and tender. The temperature is usually somewhat high, and the rise is sudden (to 103° or 104° F. within twenty-four hours), but it just as suddenly falls.

The usual course of an uncomplicated case is three to five days. It is not usual to see this disease existing by itself, but such is sometimes the case. Its most frequent occurrence is associated with acute pharyngitis, diphtheria, scarlet fever, and rubeola.

Follicular Tonsillitis.—This is a common form of the disease and is an inflammation of the tonsillar crypts, and secondarily of the whole glandular structure. The general symptoms are usually the most severe ones and are the first ones noticed. The onset is sudden, with vomiting as the rule in infancy, but a chill or chilly sensations in an older child. The temperature then rises rapidly, and may range anywhere from 101° to 105° F., with the usual associated constitutional symptoms.

The condition of the bowels is not constant, although in older children constipation seems to be the rule, while in infants there is generally a sharp attack of diarrhea with green stools. Natur-

ally, with this condition in infants the attack is often attributed to gastro-enteritis.

The first local signs are some swelling of the tonsils with a much reddened mucosa and the appearance of isolated yellow spots about pin-head size on one or both tonsils. These exudative spots mark the mouths of the crypts and project slightly from the surface of the tonsil. They can be removed with little effort and leave a slight depression, but if undisturbed, other follicles exude their contents, so that there is a punctate appearance with a tendency to coalescence. Upon swallowing there is usually some pain. The temperature persists for about four days, as a rule.

At the onset the differential diagnosis is somewhat difficult, and in infants, if the general symptoms are relied upon alone, an error may readily be made by attributing the fever, vomiting, and diarrhea to gastro-enteritis. On the other hand, in older children the attack may at first simulate the onset of malaria, influenza, or pneumonia. If a routine examination of the throat is made in all cases of sick children, as it always should be, then the danger of mistake is infinitely less.

From the general and also the local symptoms the diagnosis at first cannot be made from simple catarrhal tonsillitis, and it is not until the appearance of the plugs or spots in the crypts that one is sure about the type of the disease. When coalescence has taken place, then the condition is liable to be mistaken for diphtheria or for the membranous form of tonsillitis. The diagnosis of the latter depends largely upon the extreme fetor, the hard nodular adenitis, and the greasy friability of the membrane; all associated with mild general symptoms. From diphtheria the distinction is made by culture, for diphtheria should be strongly suspected until disproved.

In some cases the vomiting is so sudden and projectile, the fever so rapid in its development, and the throat so sore, that one might suspect scarlet fever, and under these circumstances the child should be isolated for twenty-four hours until the rash has had time to develop if the case is scarlet fever.

Suppurative Tonsillitis.—This form may end in resolution, but usually goes on to the formation of an abscess. It is not so

frequent as the other forms, and almost invariably the cases are seen in children over eight years of age. It is the only form which is regularly unilateral.

The onset resembles that of follicular tonsillitis somewhat, but the general symptoms are usually much milder, while the local ones are more marked. Then, after forty-eight hours, instead of a subsidence of the local symptoms (which is rather expected, because the general ones have shown much improvement), there is an apparent exacerbation. This is soon followed by a return of the general symptoms in all their former severity.

Deglutition becomes quite painful and movements of the jaw cause much distress. The head is held stiffly and the mouth is usually partly open, with thick tenacious mucus and saliva flowing from the corners. The speech is thick, the tongue foul, and the breath very fetid. Sordes collect upon the teeth and pain may be complained of, radiating toward the ear. The effects of pain, lack of nourishment, loss of rest, etc., all show in the general condition, which is one of weakness.

In the beginning inspection gives little data, and this should at once arouse a suspicion of suppurative tonsillitis, for in no other form is the pain so great at the onset with so little signs of disease in the tonsil itself. This is because the trouble is deep-seated at first. After twenty-four to forty-eight hours swelling is very noticeable, being rather behind the tonsil. Then the intense inflammation begins to show upon the mucous membrane of the tonsil, uvula, and fauces, with marked congestion and edema. However, less is gained in the way of diagnosis from inspection than from palpation, which should be practised whenever possible. By it, a fullness may be made out, or a point of fluctuation detected.

Abscess generally forms in from five to seven days and opens spontaneously. The diagnosis should be made as early as possible, for with appropriate treatment the formation of an abscess may usually be avoided.

Ulceromembranous Tonsillitis.—This disease may appear as a tonsillitis, a stomatitis, or a pharyngitis, and is due to a needle-shaped bacillus which is generally associated with a spirillum. The disease is communicable.

There may be an involvement of one or both sides, and the chief characteristic is the formation of a greasy and friable membrane, which is followed within thirty-six hours, as a rule, by ulceration in the tonsil. These ulcers may be very extensive and have a punched-out appearance. From their presence the breath assumes a characteristically fetid odor. Salivation is sometimes extreme and deglutition is always painful. The lymph-nodes are hard and tender, but periglandular edema is not present.

The general symptoms are very mild or wanting altogether.

The differential diagnosis must consider diphtheria, follicular tonsillitis, and syphilitic sore throat. In diphtheria there is periglandular edema instead of the hard nodular adenitis, and the membrane adheres firmly instead of being friable, greasy, and easy to remove.

The slight general symptoms or their entire absence, and the intense fetor to the breath, help to distinguish it from follicular tonsillitis. The absence of history of syphilis, the short duration of the disease, and the finding of the bacillus and spirillum of Vincent serve to clear up any doubt in regard to its specific nature.

Chronic Tonsillitis.—This may be a congenital condition, but in most instances it is an acquired one, which may develop at any time of life. The close association of adenoids with hypertrophied tonsils is a thing of common comment.

In infancy the enlargement is principally an increase in the lymphoid tissue, the tonsil remaining quite soft. In older children there is connective-tissue increase also and the tonsils show sclerotic changes with deep fissuring and compression of the follicles. There are, of course, all degrees of enlargement, therefore all degrees in the severity of associated symptoms.

If the hypertrophy is quite marked, there is a peculiar quality to the tone of the voice; articulation is indistinct. Snoring during sleep is usually a very noticeable feature. There are usually varied symptoms referable to the nervous system, and this is due to the fact that the rest is broken, that the retained secretions are swallowed, causing more or less digestive disturbance, and that the inability to breathe properly and freely interferes with the general nutrition of the child. The breath is usually foul.

Unless associated with adenoids, hypertrophy of the tonsils does not, as a rule, cause any severe symptoms.

Adenoid Vegetations.—The immediate and remote effects of adenoid vegetations of the nasopharynx upon the development and the mortality of the child are far-reaching. Not only are the nutrition and growth of the child seriously affected, but he is constantly rendered more susceptible to infections of all kinds and his power to resist disease generally is markedly lessened.

Adenoids consist of nodules of hyperplastic pharyngeal lymphoid tissue, gathered in masses and covered with ciliated epithelium. They are the result of an overgrowth of lymphoid tissue which is normally found in the vault of the pharynx.

Of the early symptoms, the most constant are snoring at night, restlessness, tendency to epistaxis, susceptibility to atmospheric changes, and bad breath. Associated with one or more of these there may be the general symptoms of anemia, general malnutrition, mental deficiency, and various reflex nervous disorders. Whenever any of these are found, or when upon examination the tonsils are found to be chronically enlarged, an examination should be made for adenoids.

When the case is fairly well advanced, the symptoms are those which are due to the chronic rhinopharyngeal catarrh and to the mechanical obstruction which is present. When the child is young, the former usually predominate, while in older children one finds that the obstructive symptoms are the most prominent.

The chronic catarrh evidences itself by persistent nasal discharge, which is mucopurulent or seromucous, and may at times be tinged with blood, the latter generally following slight trauma. With every exposure to dampness or sudden change this discharge is aggravated, and this may be so noticeable that one obtains a history that at times the child is free from any discharge.

The early obstructive symptoms are mouth-breathing, nasal voice, and lack of development. The mouth-breathing may be constant or only noticed during sleep, when the child snores more or less loudly, for the difficulty of breathing is intensified when the child lies upon the back. The result is that the child's rest is always uneasy; it tosses about, trying to assume a comfortable position. The voice is rather muffled, and this is much more

noticeable during the time that the child is suffering from an acute exacerbation of the catarrh.

When the condition has persisted for a long time, the chest may become deformed to a considerable degree. The ribs are more prominent in front and the sternum is angulated forward at the manubrio-gladiolar junction. There may also be a deep depression over the lower part of the sternum. The ribs behind are frequently closely compressed, and the lower intercostal spaces obliterated. There may be, in addition to "chicken breast," "pigeon breast" or the "funnel breast."

The question may arise, at times, as to whether the chest deformity is due to rachitis or not. This is frequently a difficult problem to settle satisfactorily, for the two conditions are so often associated.

There is usually an inability to blow the nose, and this may be total or simply partial; it may exist as an early symptom or may be a late one.

The persistent interference with rest and proper sleep and the obstruction to perfect respiration soon result in a decided condition of anemia and malnutrition, with all their associated and consequent symptoms. Various reflexes may also be excited, and it is not an unusual thing to find chorea, catarrhal spasm of the larynx, and incontinence of urine dependent upon the presence of adenoid vegetations.

The natural course of the growths is to increase up to a certain point and then remain in a stationary state until the period of puberty, at which time atrophy usually sets in. Atrophy, however, is usually not complete, as I have taken the trouble to demonstrate many times.

The mental condition of the child is generally markedly affected by the presence of the vegetations in the nasopharynx. There are noticeable forgetfulness and inability to set the mind for any length of time upon one subject. These children tire easily; not alone mentally, but physically also.

Taken all together, these cases are better in summer, and with the return of winter there is a sure return of the troublesome conditions. There is practically no tendency to spontaneous recovery.

In well-marked cases the diagnosis offers no difficulty. I do not think that it is necessary or wise to dwell upon the presence of protracted symptoms which might lead one to suspect the presence of adenoids. The examination to absolutely determine their presence is so simple and so quickly performed that whenever there is a suspicion that the child is so affected the examination should be made.

The chief source of error will be in overlooking the existence of the growths—attributing the restlessness at night, the catarrh, the anemia, and the general symptoms to some other cause. It must always be remembered that the associated symptoms do not always act as a fair indicator of the size of the growths, a small growth causing marked general symptoms if confined in a small cavity.

The best method of examination is digital exploration of the pharynx, and this is easily performed. A position should be taken by the examiner, behind and slightly to the right of the child, who should be seated in a chair or held upon the knee of an attendant. The examiner's left hand then encircles the child's head and neck, holding it firmly; the right side of the head is brought against the examiner's side. When the mouth is forced slightly open, the cheek is pushed in between the teeth, preventing the closure of the mouth; this is done with the thumb or index-finger of the left hand. The forefinger of the right hand is now carried rapidly back to the posterior wall of the pharynx, then turned upward to the nasopharynx, being pushed behind the soft palate into the cavity.

Instead of thin mucous membrane covering bony structures, there will be found a soft mass filling the cavity more or less, if adenoids are present. When withdrawn, the finger will be covered with thick mucus, and possibly with blood. The presence or the absence of the latter is of no diagnostic importance.

In the diagnosis a distinction must be made between adenoids and a fibroid tumor. The latter is much harder and firmer to the feel, but at the same time it is freely movable, and while it does not bleed readily, the absence of blood is not important, for with gentle examination it is commonly true that adenoids do not bleed.

From a polypus which projects into the nasopharynx the diag-

nosis is made by the finding of polypi in the nasal cavity also, and by the marked mobility of these growths. The rarity of polypi in early childhood and the frequency of adenoids is another determining point.

Malignant growths in this situation are extremely rare and are rapid in their development.

Acute Pharyngitis.—Catarrhal inflammation of the pharyngeal mucosa rarely occurs as an independent condition. Un-

Fig. 21.—Examination of the nasopharynx for adenoid vegetations. (The examiner in this instance is left-handed.)

doubtedly in some children there is a marked predisposition to attacks of the disease, but even in them there are usually associated lesions of the contiguous mucous membranes.

In the beginning there is a sensation of more or less dryness and smarting in the throat, which is intensified by the inhalation of cold air or the atmosphere of a close room. Associated with this, is an almost continuous desire to clear the throat.

The temperature rises to between 101° and 103° F., and the onset of the pyrexia may be accompanied either by an attack of vomiting or by chilly sensations. In infants the constitutional symptoms may be very severe. But both in infants and in older children the general symptoms are of rather short duration, being more or less marked for twenty-four hours and then rapidly subsiding in severity, so that within two or three days the child is apparently well again. There may be slight tenderness or swelling of the glands at the angles of the jaw.

The throat upon inspection appears red and dry at first, but a few hours later that gives way to a glistening appearance which is due to the presence of a tenacious mucus. All the parts may be involved—pharyngeal wall, fauces, pillars, and uvula. The redness of the membrane may be punctate, with bright red papillæ showing through the secretion which covers the duller red of the other parts.

Rhinitis, tonsillitis, laryngitis, and stomatitis may one or all be associated with acute pharyngitis, and modify it to an extent.

The diagnosis of pharyngitis is not so difficult, but to properly assign it to some underlying cause is usually quite difficult. It may be the expression of a disordered digestion or a rheumatic tendency, or depend upon other conditions, which it is quite necessary to recognize.

When the symptoms are not well defined, the chief point in the diagnosis is to exclude scarlet fever and rubeola. In the former the redness is intense and diffuse, while in the latter there is a mottled redness and probably the presence of Koplik's spots. But in either instance it may be necessary to wait until such time as the cutaneous eruption might be looked for.

Chronic Pharyngitis.—Repeated attacks of acute pharyngitis finally lead to a hypertrophy of the structures of the lymphoid ring. The posterior pharyngeal wall then exhibits a persistent hyperemia, with masses of apparently granular tissue, which are of about pin-head size. There may be a dry or a moist surface—usually the former. Hawking and coughing are frequent and the breath is apt to be offensive. The condition is not common during childhood, and in early childhood is very rare.

Acute Uvulitis.—This may be primary or associated with any inflammatory condition in the pharynx. The uvula is usually swollen to about twice its normal size, and the mucous membrane covering is reddened and edematous. The result is that the base of the tongue and the posterior pharyngeal wall are irritated by the enlarged uvula lying against them and a troublesome cough results. This is usually worse upon lying down. As a rule, the cough is the only symptom which is noticeable, although there may be a slight elevation of the temperature for a few hours. Elongation of the uvula is usually the result of an acute uvulitis, but the condition is at times congenital.

Retropharyngeal Lymphadenitis.—This is peculiar to the period of infancy and very early childhood, being rarely seen after the third year and occurring oftenest between the sixth and twelfth months of life. It consists of a collection of pus in the connective tissue beneath the mucous membrane of the pharynx. A predisposition is present in infants who are the subjects of rachitis, tuberculosis, or hereditary syphilis.

Usually the onset is insidious and without any apparent cause, although at times a history may be obtained of otitis, nasal catarrh, or of some chronic inflammation of the tissues about the pharynx. The onset is peculiar in that the child is obviously very ill, but there is apparently nothing discoverable to account for it. This may be true until the pharyngeal swelling increases to such a size that deglutition becomes difficult and respiration is more or less interfered with. Quite early in the disease, when the abscess has reached a fair size, the child cries almost constantly, and the cry rapidly assumes the character of a quack. Dyspnea may be marked.

Finally, if the cause of the foregoing symptoms has not been discovered and relieved, there is a condition which supervenes which has many of the characteristics of croup, for by this time the abscess has usually extended down so as to press upon the entrance of the larynx. Stiffness of the neck, nasal voice, mouth-breathing, and salivation may be present. With the inability to take any nourishment and the presence of the high temperature, the child rapidly emaciates.

An examination readily reveals the cause of the symptoms; as

soon as the tongue is depressed, there is noticed a bulging forward of the posterior pharyngeal wall, and at times this is so marked that the uvula and the soft palate are pushed forward also, so that they appear to be in the middle of the mouth. By digital examination fluctuation is detected in the bulging mass.

The upper and the lower limits of the mass are easily felt, though it may at times pouch downward like a psoas abscess. When the collection of pus is very large, it may point in the neck, pushing the large vessels in front and giving rise to a pulsating tumor which simulates an aneurism. The usual duration is from two to three weeks.

The chief error is in mistaking the condition for croup, but in all kinds of croup the stenotic breathing is more or less paroxysmal, while in this disease it is continuous, and the cough of retropharyngeal lymphadenitis has no croupy quality at any time. Then, again, the position in which the head is held is quite characteristic of abscess, and is observed in no other obstructive lesion (head inclined backward and toward the affected side).

LARYNGEAL STENOSIS

A stenosis of the larynx may possibly be caused by conditions outside of the larynx, which act by pressure, but such conditions are rare. In an overwhelming majority of instances the stenosis is due to diseases in the air-passages which result in swelling of the mucous membrane of the larynx. The way in which the majority of these conditions are produced is well understood, and the narrower the passage affected, the greater the result or effect following the stenosis.

In the forms of stenosis which are characteristically sudden in their onset, as spasm of the glottis, false croup, and pertussis, the mode of production is not so well understood. There is no doubt that in all of them the essential factor is a spasm of the muscles which approximate the vocal cords, and in false croup there is the added factor of inflammation which persists after the acute stenosis is over.

It is a peculiar fact that young children are markedly susceptible to special neuroses affecting the larynx, and a characteristic feature of the inflammations of the larynx is the associated occurrence of muscular spasm and consequent stenosis. This is one of the many expressions by the system of the peculiarly delicate reflex irritability of the child.

The type of breathing which is consequent upon laryngeal stenosis is not difficult of recognition. The chief features are the inspiratory sound which is produced, the retraction of the yielding portions of the chest, and the use of the accessory muscles of respiration. The sound produced by inspiration is due to the forced passage of the air through the much restricted part. The access of air into the lung is much interfered with, and the inspirations become deeper, and there results the well-defined inspiratory retraction of the epigastrium, of the soft tissues above the clavicles and sternum, and of the lateral parts of the chest.

The respirations are not alone more powerful, but they are

longer, and while under normal conditions expiration is a purely passive act, in laryngeal stenosis it becomes an active one. If the stenosis is not laryngeal, but the breathing is stenotic and due to causes outside of the trachea or the larynx (as causes in the lungs or bronchi), then the peculiar sound is absent, although all the other features may be present.

In infants who cannot breathe freely through the mouth from any cause, the occurrence of a simple rhinitis will result in many of the symptoms of stenotic breathing; but if forced to cry, the labored breathing is somewhat cleared up for a time.

ACUTE STENOSIS

The acute forms of laryngeal stenosis occur with most frequency during attacks of catarrhal spasm of the larynx and of membranous laryngitis.

Catarrhal Spasm of the Larynx.—This is not common before the first six months of life, most of the cases being observed between the ages of six months and three years. The disease seems to disregard the general condition of the child, for well-nourished and vigorous young children are attacked about as readily as poorly nourished and weakened ones. There is doubtless some hereditary influence which is active, some children being particularly prone to attacks upon the most slightly active causes.

The attack is usually of quite sudden onset, although there may be some mild constitutional symptoms for some hours preceding. These symptoms, if present, are generally a slight nasal discharge and more or less hoarseness. As a rule, early in the evening there is the occurrence of a teasing laryngeal cough, which is at times quite hard and is not frequent in the beginning. After a few hours of sleep, or about midnight, the attack comes on, and is evidenced at first by the child arousing suddenly with a hard, hollow, barking cough and some difficulty in respiration. If the dyspnea is very mild, the child may not waken. If the attack is one of moderate degree, the symptoms are somewhat severe for about fifteen to thirty minutes, and after that the signs of the stenosis markedly abate.

In severe cases the attack may persist for one or two hours, and

there is marked dyspnea, particularly upon inspiration, and this is associated with a loud stridor as the air is forced through the much narrowed opening. The distress of the child is great; the pulse is rapid and the temperature normal or slightly elevated. Generally the child sits up and makes quite frantic struggles to regain its breath, or it may in rarer instances lie quiet and prostrated, showing signs of lividity in the fingers and about the lips. The attacks are very apt to recur, and after several hours there is a gradual subsidence of all the symptoms and the child falls asleep. Upon awaking the next morning the little one is apparently well, except occasionally for the persistence of a slight hoarseness and infrequent harsh cough.

On the second night, if the case has been untreated, there is, as a rule, a recurrence of the attack, which is, if anything, more severe than upon the preceding night. Upon the third night the attack is markedly reduced in its severity, and usually at that time does not amount to anything more than the occurrence of a harsh, croupy cough with some restlessness, disturbed sleep, and mild dyspnea. It is not unusual for a slight hoarseness to persist for several days following an attack, and this is irrespective of its severity.

There is some danger of mistaking the disease for laryngismus stridulus, and some authors speak of both conditions as being similar. This is an error, for laryngismus stridulus is somewhat rare and is observed only in infancy and is the expression of an entirely different condition (malnutrition). In it we observe not only the peculiar form of breathing, but there is an absolute cessation of respiration, and this may be repeated several times daily over a protracted period.

The greatest difficulty is encountered in clearly distinguishing catarrhal spasm from membranous laryngitis. The latter does not usually exhibit a sudden development of stenosis, the child showing symptoms of a catarrhal laryngitis generally for two or three days preceding the severe symptoms. There has usually been some slight change in the voice and the occurrence of a mild and easy, infrequent cough. The symptoms are not relieved upon the following day, but grow gradually worse, so that in nearly every instance we observed slight symptoms for a day or

two, growing gradually but progressively worse and with an added stenosis. The dyspnea is not so spasmodic in character, but is more continuous. If it is possible to obtain a well-defined history of previous attacks, it favors a diagnosis of catarrhal spasm, and if the inhalation of a small quantity of chloroform fails to have any appreciable effect upon the dyspnea, then the presence of a membrane is to be suspected.

Membranous Laryngitis.—This inflammation of the larynx is characterized by the formation of a false membrane which depends for its existence upon bacterial infection. It may occur as a primary affection, but such is not usually the case, as it is much more frequently secondary to diphtheria of other parts. The membrane does not exhibit any peculiarities which are at all characteristic of the particular microbe which causes it.

The membrane exists in all degrees of thickness and extent, so that in some cases it simply appears as a thin film, and in others is thick and practically occludes the opening in the larynx. Spasm is associated, and in many instances is the chief element of danger.

At first it is impossible to distinguish the membranous from the catarrhal form, for there is the same hoarse cough and voice, which are accompanied with gradually increasing stridor, but these are not apt to be so abrupt in their onset or so severe in their course during the first few hours in the membranous form.

The diagnosis is usually made by the progress of the disease, and if there is a gradual increase in intensity of all or most of the symptoms, the case is more than likely of the membranous form. On the other hand, one occasionally encounters cases in which for a week there are persistent hoarseness, teasing cough, slight constitutional symptoms, and moderate dyspnea. Then suddenly severe symptoms develop, the breathing becomes markedly stenotic, prostration is rapid and extreme, and the child dies in a few hours.

The usual course, however, is for the child to progressively become worse as time goes on, so that a child affected first in the morning will generally exhibit worse symptoms by night. Dyspnea and hoarseness, which are slight at first, soon become marked, and the voice may be entirely lost. Upon the second day the symptoms are such that the chances of a mistake are mate-

rially lessened. The face wears an anxious expression and is apt to be quite pale, and the alæ nasi dilate with the labored respirations. Stridulous breathing is very evident, and the dyspnea is much increased, causing real distress to the child. The unusual paleness of the face is often in marked contrast to the lividity of the extremities, although late in the disease the face may become much cyanosed.

The rise in the temperature generally follows fairly closely the severity of the symptoms, so that when the symptoms are well developed and severe, the temperature may reach 105° F. or higher. When the disease has persisted for some days, the intellect is usually dulled or the child may pass into a comatose state. In children over three years of age the usual duration of the disease is from three to seven days, but in those under three the course is apt to be much more rapid and severe.

The diagnosis must take into consideration several diseases which at first show a marked similarity. First, in regard to catarrhal spasm. A sudden development of a transient stenosis, in contradistinction to a slowly but progressively developed one, is indicative of catarrhal spasm. The cough in spasm is at once hard, harsh, and teasing, and not gradually developed and moist. The cyanosis and dyspnea are somewhat transient in catarrhal spasm.

From acute catarrhal laryngitis the diagnosis may be exceedingly difficult in the beginning. The use of the laryngoscope, which would furnish conclusive evidence in children approaching adult life, is valueless in young children, as they will not allow its use. Early in the disease the temperature is higher in the acute catarrhal form, the dyspnea is inclined to be paroxysmal, is chiefly inspiratory, and worse during the night.

Dyspnea in the membranous form is constant, progressively increases, and is expiratory as well as inspiratory. In the catarrhal form the voice is hoarse but not lost. The association of enlarged glands, membranous patches in the throat, and the presence of albumin in the urine (if it has been previously free from it) would all indicate the membranous form.

In any event an examination must be made of the secretions of the throat, and as it is well-nigh impossible to get a specimen from within the larynx, the smear must be taken from some of

the adjacent structures. In about 80 per cent. of the cases the membrane is due to the Klebs-Loeffler bacillus, and if this is found, the case is one of undoubted membranous laryngitis. The absence of the bacillus proves nothing.

Retropharyngeal lymphadenitis may for a time simulate membranous laryngitis, but digital exploration will soon clear up any doubt that may exist. A foreign body exhibits some signs which are misleading, but the history is usually clear on this point and there is a very sudden onset of the symptoms without any rise of temperature.

Acute Catarrhal Laryngitis.—This disease is not so common as catarrhal spasm, but is apt to be more severe. It occurs with most frequency between the ages of two and five years. Except as it is due to injury, it does not occur as a primary disease, always being secondary to some disease of the respiratory tract or to one of the infections (especially rubeola, variola, and scarlet fever).

The symptoms in the beginning are a characteristically harsh, barking, violent cough, which is worse during the night and is associated with hoarseness. These may continue to be the only symptoms noted, or they may be accompanied with slight constitutional disturbances, as slight elevation of the temperature, general malaise, and anorexia, all of which persist for a few days while the child protests against being confined indoors.

Even in these mild attacks in older children the tendency to relapse from slight causes is marked. On the other hand, the child may be seized rather suddenly with the disease and be aroused during the night with all the classic symptoms of an attack of croup, the evidences of air-hunger being particularly obvious. Generally such an attack quickly subsides after a vomiting spell, and the child falls asleep, showing little evidence of his recent distress and struggles. Or in other instances the attack may persist up to the point of extreme exhaustion, the violent efforts to obtain relief resulting in pulmonary congestion from aspiration of blood. When the resulting carbon dioxid narcosis has supervened, then there is usually a relief from the dyspnea, for the spasmodic element is abolished. There is a tendency to recurrence upon the two following nights.

When the child is very young or in a poor physical condition, death may take place during the attack.

The differential diagnosis from other forms of laryngitis has already been considered.

Edema of the Glottis.—While this condition is rare in early life, still it is occasionally the cause of laryngeal stenosis in children. It is characterized by a long period of inspiratory dyspnea and stenosis which may lead to asphyxiation. There is an effusion into the submucous cellular tissue, the infiltration of serum being chiefly in the epiglottis and aryepiglottic folds, so that the swelling which takes place causes the appearance of rounded swellings projecting on both sides of the superior isthmus. These are readily detected by digital examination. The voice usually remains clear, as the vocal cords are not involved. There is generally a constant desire and effort to clear the throat, so that the associated cough is ineffectual and wearing. The development of stenosis is both rapid and severe.

If the cause of the edema is an inflammatory one, then there are pain and tenderness. In addition to the symptoms mentioned, there are those of the original disease, to which this is secondary.

The exciting cause of this condition may be the presence of a foreign body, the swallowing of acids, strong alkalis, or hot liquids, the inhalation of steam or irritating vapors, or it may be due to anything which causes a local irritation. In other instances it follows the occurrence of the acute infectious diseases. It is most frequently observed as a very serious complication of serious disease of the kidneys, the heart, the lungs, or the liver.

A rare disease in itself, it is rarely evidenced as an angioneurosis. The diagnosis is made by direct inspection or, better still, by digital exploration.

Submucous laryngitis is almost identical with edema of the glottis, but differs in being an inflammatory form of edema which is dependent upon some adjacent inflammation. The examination shows that all the structures around the upper opening of the larynx are intensely reddened and inflamed and the epiglottis is observed to be swollen and thickened (seen by depressing the tongue thoroughly).

Foreign Body.—In the diagnosis of a foreign body as a cause of acute laryngeal stenosis the history is of great value. Such bodies are most apt to be drawn into the child's larynx during coughing, laughing, or crying. It is also common for children to go to sleep with small articles in their mouths. Hasty or imperfect mastication is another element. If the child has a paralysis of the laryngeal muscles, then such an accident is very much favored. The possibility of lumbricoid worms finding their way into the throat must not be forgotten.

The symptoms in the beginning are modified by the size, shape, and location of the body. Cough (the effort to expel the foreign substance) is generally severe and prolonged, so that the child is soon exhausted. This is associated with more or less dyspnea. Both of these may suddenly subside (as the body slips into a less irritating and obstructive position), only to return again within a few hours.

The diagnosis is generally clear from the history, but at times this may be wanting, and then the case is one of considerable difficulty. In any case of doubt digital exploration is the quickest method of determination, and it may be necessary to practise this with the child in the inverted position. The *x*-ray will suffice to locate the foreign body if it possesses enough density.

Retropharyngeal lymphadenitis is by no means uncommon, but is often overlooked as a cause of laryngeal stenosis, and this is particularly true of infancy. It is due to an inflammation of the deep lymphatic glands which receive the lymphatics of the tonsils, soft palate, and pharynx. The onset is singularly insidious, and although the child seems very ill, there is apparently nothing to account for it. Finally, as the pharyngeal swelling appears, deglutition is very painful and the symptoms of stenosis appear. These come on about seven to fourteen days after the first signs of the indefinite illness. The only means of positive diagnosis is by digital exploration of the pharynx (see page 84).

Laryngismus Stridulus.—This is not a common condition and is peculiar to infancy. It is a neurosis purely and must not be confused (as it is by some authors) with catarrhal spasm of the larynx or acute catarrhal laryngitis. The neurosis manifests itself in an irregular spasmodic action of some of the respiratory

muscles, and is most often observed as a spasmodic contraction of the adductors of the glottis, interfering with the free access of air.

Its occurrence closely corresponds with that period of life in which the nutrition is apt to be faulty (up to the eighteenth month), and its association with rachitis is marked. In a large proportion of the cases there is craniotabes also, and the association with rachitis is so pronounced that some authors state that it is invariably of rachitic origin. Occurring as an indication of rachitis, it precedes the time when there is any marked bony change, so that its recognition is valuable for the institution of preventive measures. The marked instability of the nervous equilibrium of rachitic and malnourished children is undoubtedly the predisposing factor in its occurrence.

The attacks may occur at any time of the day, during waking or during sleeping hours. The attacks are mild in the beginning, and this quality causes them to be overlooked for a long time, but they become progressively more severe as time goes on.

The attack is always sudden. There is a spasmodic inspiratory stridor, accompanied with a crowing sound as the air is rushed through the much narrowed glottis. The head is thrown backward and the face becomes first pale and then possibly livid as respiration is arrested. In other instances the reverse is the order, the crowing sound not being evident until the spasm shows a period of relaxation. Then, again, there are several atypical attacks. It may occur simply as a spell of "breath-holding" during anger or fright. There may be a series of audible sobs, ending in a whoop which somewhat simulates pertussis. It may occur simply as though the infant was catching its breath. It may be only evident for a time when the infant awakens, and then is observed as a short inspiratory sob or crowing.

If the attacks are at all severe, the infant is left slightly weakened and perhaps drowsy. When the attacks are severe, the respiratory muscles are held rigidly in a state of extreme inspiration and consciousness may be lost. Carpopedal spasms and general convulsions may follow. The inclination to relapses is very strong as long as the causative condition (malnutrition) is present. The attacks may occur several times each day or may be separated by more or less protracted periods.

In the differential diagnosis the main points to be considered are the repetition of the attacks, the general evidences of a rachitis or chronic state of malnutrition, and the age of the infant. If tetany is present, then the diagnosis is simplified.

CHRONIC STENOSIS

When the larynx is affected by a disease which causes a chronic stenosis, the voice loses its normal tone and becomes much harsher than usual. In other cases the voice is entirely lost for a time. The most frequent cause of such a condition is chronic laryngitis, and less frequently syphilis and new-growths.

Chronic Laryngitis.—This disease is usually consequent upon repeated acute attacks, and is often associated with tonsillar enlargement and its usual companion, adenoid vegetations. There is a peculiar hoarseness or huskiness to the voice which is chronic, but subject to the occurrence of acute exacerbations from very slight causes (as fatigue, exposure to cold or dampness, inhalations of anything irritating, etc.). Sometimes, but not always, there is an ineffectual cough present and a constant desire to clear the throat. The symptoms are always improved under the influence of dry and warm weather.

Syphilitic Laryngitis.—If hoarseness occurs in early life and is persistent, it is always suggestive of syphilis, and while the invasion of the larynx is not so common as affection of other parts, still one must be on his guard to diagnose the case early. When there is a perfectly clear history, or when there are unmistakable signs of the disease, the diagnosis is easy enough. But a great difficulty at once arises if the invasion of the larynx is the only apparent manifestation of syphilis, as it occasionally is. The favorite site is the epiglottis, and the favorite lesion is condyloma. It appears as a thickened, deformed, hollow cylinder of a whitish-red color, and may sometimes be recognized without the use of the mirror, but in most instances the examination must be thorough to discover the lesion.

When there is a suspicion aroused, the anus and the corners of the mouth should be examined for evidences of an old syphilitic scar. The remains of old condylomata may be discovered in any

situation. Usually the invasion of the larynx does not take place until between the ages of three and ten, because of the tendency to occur only in relapses of the disease.

Tubercular Laryngitis.—This probably never occurs as a primary disease in children, but is always secondary to disease in the lungs. The disease really belongs to the period of late childhood, and even at that period is rare, so that the disease may be considered almost as a curiosity.

The few cases that have occurred have been evidenced by constant and more or less severe pain, harsh voice, and cough of a teasing character. The symptoms of the disease in other parts are well defined before the occurrence of the laryngitis.

Tumors of the Larynx.—In childhood these are almost always papillomata, and the growths may be single, multiple, sessile, or pediculated. The first symptoms are generally a chronic hoarseness and a paroxysmal cough, which is soon associated with loss of the voice. The cases are in the beginning very similar to chronic laryngitis, and a positive diagnosis involves the use of the laryngoscope and the detection of the growths which may be attached to any part of the larynx.

CONGENITAL STENOSIS

Congenital Laryngeal Stridor.—This is a rare condition, but one which must not be confounded with laryngismus stridulus, which occurs in later infancy. The act of respiration is accomplished with a purring sound which may terminate in a distinct crowing sound. This is constant and is increased by excitement. It disappears during the first hours of sleep, when unconsciousness is profound. The voice (as evidenced by the cry) remains clear and there are no associated symptoms of any kind. A disappearance occurs later in infancy.

DYSPHAGIA

Dysphagia is a symptom which is common to all the affections of the esophagus. It varies from the simple dysphagia which is due to pain and that which is dependent upon complete obstruction of the tube. This latter type is due to pressure outside of the tube, to disease of the tube, or to the presence of an obstructive body in the tube.

The esophagus is in close contact in some part of its structure with the trachea, the thyroid gland, the left bronchus, the bronchial glands, and the arch of the aorta, so that any condition causing enlargement of these structures may bring about dysphagia. With the trachea affected, dyspnea is prominent; enlargement of the thyroid gland is easily demonstrated by palpation and inspection. The other named structures, being enlarged, cause pressure, and therefore dysphagia, by pressing the tube against the vertebræ. This is particularly true of enlarged bronchial glands.

It is easy to see how organic disease of the tube would result in difficulty in swallowing. This might be occasioned by an acute inflammation or by a chronic one. In the acute forms the act of speaking is also painful and the pain is usually of a raw or smarting character. In the chronic forms swallowing of liquids is, as a rule, easy and painless; speech is not painful and there is an abundant secretion of viscid mucus. Stricture generally follows traumatic inflammation, after a long period (three to six months), is gradually developed, painless, and is readily located by the use of the bougie.

Dysphagia which is excited by the presence of a foreign body is usually not difficult of recognition and depends upon two things: the presence of the body and the excitation of spasm. Dyspnea is associated with the dysphagia, and its degree depends largely upon the size of the obstructing mass. The spasm causes regurgitation of the food.

Of the functional affections, spasm is the most common. It occurs in children whose nervous systems are very irritable. The attack usually comes on while the food is being taken, and it is at once regurgitated, after which swallowing is accomplished slowly if it is done at all. In paralysis the difficulty of swallowing is the main symptom, and as the larynx is usually paralyzed also, there are the associated symptoms of the two. Paralysis is very rare.

The phlegmonous anginas, retropharyngeal lymphadenitis, severe diphtheritic and scarlet fever throats all cause more or less dysphagia. The erosions which are sometimes left on the tonsils after the diphtheritic membrane has cleared off constitute a very common cause.

Dysphagia may be complete in hydrophobia. In the inherited stenosis, if there are diverticula, the food gets into these and may be expelled some hours later. Congenital malformations, like cleft palate, and paralysis of the soft palate which follows diphtheria, both cause considerable dysphagia, but it is always accompanied with choking.

DISEASES OF THE ESOPHAGUS

Malformations.—These are very infrequent, and only such will be mentioned as are of diagnostic import.

A congenital narrowing of the esophagus near its lower end may allow some of the food to pass into the stomach, while a portion may be regurgitated. Under such conditions the tube becomes gradually enlarged above the constriction and the digestion may be fairly good. The stools are scanty, however, and the usual outcome is that the infant rapidly succumbs to an acute inanition. Tracheo-esophageal fistula generally terminates by the infant dying with an aspiration pneumonia.

Leaving malformations out of consideration, the esophagus is liable to all affections which arise in mucous membranes, but its histological structure, its functions, and its position protect it to a marked degree, so that it is true of childhood, at least, that affections of the esophagus are very rare.

Acute esophagitis may be of two types—catarrhal or corrosive, the latter being the most frequent form. The catarrhal form is of no clinical importance and is rarely met with. It may be due to traumatism which may excite a simple catarrhal inflammation or there may be deep ulceration from injury. The only symptoms are dysphagia and slight elevation of temperature.

Corrosive esophagitis depends usually upon the same causes as does corrosive gastritis the swallowing of corrosive poisons. Frequently the brunt of the action of the poison is borne by the esophagus, and the effects may be very superficial or, on the other hand, very deep. If the epithelial layer alone is involved, there are no appreciable consequences, but if the destruction extends deeper than that, the results are usually serious.

The early symptoms are not clearly defined from those of inflammation of the mouth, the pharynx, and the stomach. There is a burning or smarting sensation in the parts, accompanied by intense thirst and spasms of the esophagus at every attempt to

swallow. Deglutition is very painful and usually impossible. Following this, there is a period of acute inflammation which persists for a few days, during which time the pain is much increased and the danger is from edema of the glottis. Then comes a period of freedom from all symptoms until the time that constriction is apt to take place, and this is from three to six months afterward.

Retro-esophageal abscess is rarely diagnosed during life, although it may have been suspected. The only marked symptom is dyspnea, which is most pronounced upon inspiration. The condition might be suspected in tuberculosis of the lower cervical or the upper dorsal vertebræ when sudden inspiratory dyspnea appears.

APPETITE AND THIRST

THE APPETITE

Anorexia.—Loss of the appetite may be due to many diseases, and is a constant feature of all the organic diseases of the stomach. In the so-called functional disturbances of the stomach and intestines anorexia is usually marked, but it is by no means a constant symptom. It may depend upon conditions remote from the stomach, but which affect that organ reflexly, and in this connection cerebral irritation occupies first place. The emotions are very frequently the cause of loss of appetite.

A moderate gastritis accompanies all fevers, and loss of appetite is a constant accompaniment of elevated temperature. This is more marked during the course of some fevers, but is never so prominent as it is in epidemic influenza—a point which may be of value sometimes in differential diagnosis.

Loss of appetite is sometimes the chief complaint which the parents of children of school age make, and in nearly every instance the cause will be found in an anemic condition of the child. No matter what the type of anemia, anorexia is usually a marked feature. That the lack of desire for food is due to the anemic state may be demonstrated by the discovery of other symptoms, for these children are usually narrow-chested, pale, muscularly weak, easily fatigued, restless at night, and inclined to mental morbidity. The tongue is usually clean.

A somewhat similar picture might be given if the child was suffering from chronic gastric indigestion, but the tongue is then more or less thickly coated and nausea is present at times. To exclude nervous indigestion, an examination might have to be made by stomach washing.

In hysteria the first indication of the condition may be a loss of appetite, and this may show itself as a total loss or as an aversion to certain articles of diet. Acting under the influence of an idea, to excite sympathy, to attract attention, or to become thin,

there may be a marked reduction in the amount of food taken or there may be total abstinence. The usual form, however, is that several articles of food are placed under a ban and are absolutely refused.

When the anorexia amounts to a disgust for food and gastric and cerebral influences are excluded, the possibility of suppuration going on somewhere in the body should be thought of and determined. When the taking of food is accompanied by pain, the child very naturally refuses to partake of it, so that anorexia becomes a part of dysphagia at times and is always associated with those conditions in the mouth and fauces which are accompanied with inflammation.

Increased Appetite.—This should be expected after any illness, whether it be acute or chronic, and which has interfered with the child's nutrition or which has taxed the strength of the little one. It is desirable and natural only up to that point when the child is restored not to its former condition necessarily, but to that condition which is normal for a child of corresponding age and size.

If the appetite goes beyond this point, it is then an evidence of gluttony—a condition or habit which is not uncommon in childhood, and especially so among nurslings. It is one of the most prolific causes of gastric disorder and lays the foundation for the common inflammatory diseases of the stomach and intestines to which children are so prone. Other than this, it is a peculiar fact that it is very commonly the first symptom of marasmus: the child wants to nurse constantly. Gluttony is very common among rachitic children, idiots, and those suffering with diabetes. In chronic diarrheas its existence is of somewhat different import; it is still gluttony, but dependent upon the child's craving for fluid, and the liberal administration of fluid internally and externally soon relieves the situation.

After an attack of vomiting there is very apt to be increased craving for food, unless pyrexia is present. During the course of pertussis, when there is much vomiting, there is usually an increased appetite, and this may show itself immediately after an attack of vomiting. The presence of intestinal parasites, particularly tapeworm, generally results in a capricious appetite: one

time there is a partial anorexia, and at the next meal the appetite may be gluttonous, the latter being the most frequent occurrence.

Pica.—This is a habit neurosis which evidences itself in perverted appetite. There is no end to the number or variety of things which may be ingested. This disorder is distinct from bulimia, which is simply an exaggeration of the normal appetite, for in pica the appetite is not necessarily increased, but is perverted.

As an etiological factor age has little, if any, influence, but a marked hereditary influence has been noted. How much of this is simply due to instability of the nervous system is hard to determine. Malnutrition seems to be a strong factor, as is also anemia; but when one comes to examine into these factors, it is hard to tell whether they may be predisposing causes or not. Feeble-minded children are particularly predisposed to pica. It is a frequent manifestation of hysteria.

Imitation is probably the most prolific cause, and given a child with a strong neurotic inheritance, it requires but little suggestion to determine the formation of the habit. Among school-children it is common to find that several companions are addicted to the eating of chalk, paper, etc.

In infancy the habit is readily formed by the conveyance of certain things which the infant picks up and carries to the mouth; this is done repeatedly until a habit is formed. Once formed, there is a constant desire to place all sorts of articles in the mouth. Many of the cases have been associated with the presence of worms in the intestinal tract.

The symptoms are easily summed up in the fact that there is perverted appetite, the ingestion of different articles causing varied immediate symptoms and the perversion leading to remote effects, usually nutritional. The tendency is to gradually increase the quantity of dirt or other substance eaten and to proportionately decrease the amount of natural nutriment taken. The infantile type differs from that of later childhood by being much less severe in degree and persistency. The course of the disease is about one year.

THIRST

Increased thirst is a constant symptom of all gastric disorders, and is usually very marked in those in which there is much inflammation. It is the natural accompaniment of all diseases in which there is a rise of the body-temperature.

It is associated with all conditions in which the body suffers a loss of fluid, so that one finds it in diarrhea, and especially that of a profuse watery type, after sweating from any cause, following attacks of vomiting, and when there has been a considerable loss of blood. The influence of habit must not be forgotten in considering the cause, for it is more common than usually supposed. In diabetes insipidus and during cholera infantum the thirst is excessive.

VOMITING

The act of vomiting may be centric, toxemic, or reflex. It occurs during infancy with great frequency and from apparently slight causes, and throughout the whole period of childhood it is more easily excited than in the adult. This is due, in the main, to two facts: the natural instability of the nervous system of the child and the anatomical features of the stomach in the young.

The stomach of the infant develops rapidly, especially in the region of the fundus, the longer curve showing the greater increase and the stomach wal s becoming rapidly more muscular. This rapid growth changes the position of the organ, which originally was such as to be completely covered in front by the left lobe of the liver, so that at five or six months a portion of the organ is below the liver. The general position is somewhat more vertical than in later life, and the cardiac curvature is less, while the whole organ lies higher during the first six months than at any subsequent time.

The general position, the tubular shape, and the underdeveloped esophageal sphincter all tend to make vomiting easier. These evidences of immaturity usually persist more or less for the first year of life.

For the purposes of diagnosis it is necessary that a distinction be made between vomiting and eructation.

Eructation.—Eructation occurs in perfectly healthy infants, the returned food in the vomitus exhibiting little or no change in consistency or odor. Thus one knows that the act is probably a conservative one. It occurs without any evidence of preceding nausea or of any appreciable effort upon the part of the infant. There is no alteration in the comfort or the temper of the little one. It is in nearly all instances an evidence of overfeeding or of hasty feeding, and unless habit has already been formed, attention to these two causative factors results in its discontinuance.

Overfeeding is evidenced by regurgitation of the food, changed

but little, if at all. Too rapid feeding is easily demonstrated by timing the ingestion of a measured quantity. Irrespective of overfeeding or too rapid feeding, pressure over the infant's stomach or abdomen, or, what is just as bad, tossing and exciting the infant soon after feeding, will cause eructation of the food.

The act is sometimes accompanied with facial grimaces (the infant seeming to go through the act of swallowing, immediately preceding the eructation), and if such persist, we may be sure that eructation is due to habit.

Vomiting is almost always preceded by nausea, which varies greatly in its degree. Nausea is evidenced in infancy by restlessness, facial pallor, and increased respiration; then the act of vomiting quickly follows.

The complicated mechanism of vomiting is governed by a special center in the medulla, near the respiratory center, so that this may account for the quickened respirations accompanying the nausea. The act requires effort. The initiation of the act is by a deep inspiration, which is followed by spasmodic contraction of the abdominal expiratory muscles, during which the glottis is closed and the diaphragm is held low. The pyloric orifice is contracted tightly, and the cardiac orifice relaxed, the stomach itself being relaxed or the subject of peristaltic movements.

It is not well to consider vomiting alone, but as it is related to other symptoms, and so, for the purposes of simplifying the diagnosis of its cause, I shall make this division of the subject:

1. Vomiting accompanied by little or no rise in temperature.
2. Vomiting accompanied by decided rise of temperature.
3. Vomiting from toxemia.
4. Vomiting associated with obstinate constipation.
5. Diseases of the stomach with vomiting as a prominent symptom.

VOMITING ACCOMPANIED BY LITTLE OR NO RISE IN TEMPERATURE

Nearly every infant acquires quickly the habit of poking its fingers into its mouth and frequently its success is so marked that the irritation of the fauces brings on vomiting as a reflex.

Habit also plays a much more important rôle than we are usually willing to admit. Following some disturbance of the digestive system which has excited more or less vomiting of a somewhat mild degree, the formation of the habit keeps up the frequency of the act or it may be acquired from the more common regurgitation of food. The lack of all evidences of preceding nausea and the presence of persistent facial grimaces which accompany this form of food expulsion are usually pronounced enough to make the diagnosis easy.

Neurotic Vomiting.—Vomiting may at times be due to some neurosis, but before it can reasonably be attributed to this cause, there must be a clear and positive exclusion of every other possible cause. During such vomiting there is no appreciable effect upon the general condition or the appetite and cheerfulness of the child.

Nervous diseases may have vomiting as a prominent symptom at their onset, and vomiting from this cause is sudden, projectile, and without any relation to the meals. The tongue is clean if the case is uncomplicated. Vomiting of this kind is frequently the first symptom that is encountered in brain tumor and acute or tubercular meningitis.

Overdistended stomach is a very prolific cause of vomiting, but still more of eructation. Such vomiting is preceded by a more or less protracted period in which eructation is prominent and closely follows the ingestion of food. The vomitus contains the food but slightly changed, for it has not been in the stomach for a great length of time. Usually only a small portion of the meal is ejected and there are no sequelæ.

Intestinal worms may excite the act of vomiting, and the most characteristic thing about this type of vomiting is that it occurs when the stomach is nearly empty and the taking of food relieves any tendency to its immediate recurrence. Of course, the only positive evidence of the presence of these parasites is the observance of them, their segments, or ova.

Following a Coughing Spell.—Vomiting immediately following a spell of coughing should at once arouse a strong suspicion of the possibility of pertussis, and if the child is a nursling, this symptom alone is almost pathognomonic. As the child becomes older,

however, this suspicion must be modified, as there are several other conditions which are likely to cause it, and these are:

(*a*) Pharyngitis not uncommonly renders the mucous membranes so hyperesthetic that vomiting is very readily excited by the mere act of coughing.

(*b*) In affections of the respiratory tract which have as an accompaniment the production of a thick, tenacious mucus, the necessary efforts put forth by the child to expel the mucus may easily excite vomiting.

(*c*) When a child has recently suffered from pertussis and acquires bronchitis, the recent acquisition seems to have some power to bring back the tendency to vomiting which has been evident during the pertussis.

In all cases of vomiting without fever one must remember the possibility of poisoning. The history of the ingestion of a toxic substance, the associated symptoms due to the action of the substance, and the associated collapse would all help to determine the cause.

In children with marked refractive errors, if the eye is suddenly put to some unusual strain, or such a strain is unduly prolonged although not severe, vomiting associated with headache and rubbing of the eyes is very apt to occur.

Vomiting occurring in the course of post-diphtheritic paralysis is of evil import. It is very apt to be of a violent type and persistent, and the danger is great, for it is almost invariably associated with a greatly weakened condition of the heart and other signs of affection of the vagus. Occasionally such vomiting is the first thing to attract one's attention to the seriousness of the paralysis, for in many cases the paralysis is mostly cardiac. Vomiting is most apt to occur in the serious cases, and especially during those periods of acute exacerbation of the paralysis symptoms, which are almost crises. Vomiting occurring within ten weeks of an attack of diphtheria should arouse the greatest suspicion and caution.

VOMITING ACCOMPANIED BY DECIDED RISE OF TEMPERATURE

In infancy vomiting occurring with a decided rise of the body-temperature has no distinct diagnostic value. These little ones are so susceptible that pyrexia, independent of its cause, is rarely unattended by vomiting.

In older children this does not hold true, for frequently the cause of the vomiting is an error in diet at the onset of the elevation of temperature, and the two have therefore no connection. It is important that this question be decided, however, and the character of the vomitus would be a great aid; first, by the detection of particles of indigestible or undigested food; and, secondly, by the time at which the vomitus was expelled, in relation to the last meal, for this would give one a line upon the efficiency of digestion.

With dietetic errors eliminated, sudden rise of temperature, accompanied or preceded by vomiting (except in infancy), is very suggestive of the onset of one of the acute infectious exanthemata, and this is especially so if the act is not repeated. Of all the eruptive fevers, vomiting is most frequent at the onset of scarlet fever. (See further in this section.) If the child is three years or over and the eruptive diseases can be reasonably excluded, we have still to think of the possibility of the onset of erysipelas, meningitis, peritonitis, pneumonia, and malaria.

Cerebral vomiting is always sudden and projectile in character and occurs without any evidences of previous nausea. The act occurs as though it was the contents of the mouth being expelled instead of those of the stomach. Such vomiting may occur while the stomach is empty of food, and is most apt to occur during or immediately after a change of position from the horizontal to the vertical. The persistency is the chief characteristic of cerebral vomiting; it yields to no diet or treatment and each act leaves the little one more and more prostrated and without that evident sense of relief which comes by expulsion of the stomach content in other types of vomiting. It is very rare that vomiting with these features is anything other than cerebral, but it may occur in other conditions, with all the characteristics of a centric origin except the persistency.

Scarlet Fever.—In young infants the initial vomiting which takes place at the onset of this disease is soon accompanied by more or less diarrhea, which may last for one or two days. These two occurrences, taken together, are certainly, in young infants, the earliest features of the disease. After the first seven months there is but little difference in the onset of the disease, which depends upon age. The vomiting may be repeated several times during the first six hours and then suddenly cease, or the more common occurrence is one initial attack of vomiting. Within twelve to twenty-four hours the child complains of sore throat, and this is an aid in diagnosis, for while the throat may be markedly inflamed in other diseases which in their mode of onset simulate scarlet fever, there is seldom any complaint made of early soreness. Any child with sore throat, high temperature, and vomiting suddenly appearing should be isolated until the suspicion of scarlet fever can be definitely determined.

Variola.—The vomiting at the onset of variola is not a distinctive feature, but when accompanied with high temperature in which the usual accompaniments of elevated temperature (pains in the limbs and head, restlessness, lassitude, and possibly delirium) are all intensified out of all proportion to the height of the fever, it is fairly characteristic of this disease. With a definite history of exposure and without protection afforded by recent vaccination and the lumbar pain predominating, the diagnosis is practically certain.

Peritonitis.—The vomiting, which is an early occurrence, usually persists throughout the whole course of the disease, but in rarer instances may be present only at the onset. The facies and the abdominal symptoms generally quickly help to determine the diagnosis.

Pneumonia.—The onset of lobar pneumonia is almost invariably sudden, and vomiting is one of the first and most constant symptoms. Unless there has been considerable dietetic error, the vomiting is not continued.

Vomiting is an early and a very severe symptom in cholera infantum.

VOMITING FROM TOXEMIA

The acute infections are all types of toxemia which usually results in the production of vomiting, but, aside from these, an accumulation of various toxic substances in the blood may excite the act of vomiting. There may be little or no rise of the temperature associated with the vomiting, or, on the other hand, the rise may be considerable.

The same thing may be said in regard to accompanying prostration: it may be slight or, in young infants especially, it may be the only alarming feature. The uremic type may be diagnosed by urinalysis and the history of causative factors. All other types must be diagnosed by exclusion, unless there are very pronounced associated symptoms or a definite history to guide one in the determination.

Recurrent vomiting (cyclic vomiting, lithemic vomiting, etc.) occurs almost exclusively during childhood, and especially in infancy, and a small majority of cases occur in girls. It is somewhat more common in winter than in summer. Heredity is the most important predisposing cause, and a general neurotic inheritance is the rule. Other very prominent causes are constipation, mental overwork or excitement, and liver incompetency.

I mention these in detail because I am convinced that it is a form of toxemia occurring in children who are neurotics. While some have claimed a purely neurotic element in the production of the attacks, the fact that these children are neurotics would readily explain the severity of the attack and also its periodic occurrence, when the eliminative forces have been inactive for a time before the onset. It is distinctly a self-limited condition (this is agreed by most writers), and this favors its toxemic instead of its neurotic causation.

Prodromes are usually present for a few hours or even days preceding the attack, and the more common are flushing of the cheeks, coryza, nerve irritability, restless sleep, sluggishness, constipation, sallowness, and bad breath. Following the prodromes, vomiting occurs within six to twenty-four hours and is the most characteristic feature. It is usually severe at first and accompanied by more or less nausea. The food is expelled at

first, then mucus, bile, and sometimes blood-stained mucus. The vomiting is repeated without apparent cause and with violent retching, as a rule, continuing for one or four days, then suddenly ceasing.

The interval between attacks may be one month, but is more often three months, and all attacks are markedly similar in most particulars. If the child is under five years, more or less digestive disturbance is apt to persist between attacks.

The diagnosis is exceedingly difficult in the first attack, but after one or more recurrences the diagnosis is far easier, and after several attacks is very plain. The first attack will usually be regarded as a ptomain or toxic gastritis, but intestinal symptoms which accompany gastritis are absent and starvation treatment has no effect.

Intestinal obstruction simulates recurrent vomiting to an unusual degree at times, but there is absence of pain and of the bloody mucous stools which are generally present in the former; also there is no detection of any tumor.

VOMITING ASSOCIATED WITH OBSTINATE CONSTIPATION

Congenital malformations of the rectum are not infrequent. Atresia ani of a mild degree consists in a failure of invagination of the skin while the rectum occupies a perfectly normal position. In another form the rectum has been diverted in its course or has undergone an arrested development, so that the anal portion ends in a blind pouch. In more severe forms the rectum and anus may both be defective in their development and be considerably separated. Other malformations are abnormal termination of the rectum in the vagina, perineum, bladder, and urethra.

If the imperforation is situated high up in the rectum, or if the obstruction is complete, no meconium is passed, the abdomen becomes somewhat rapidly distended, there is an unhealthy hue to the skin, and, later on, persistent vomiting occurs. The source of the trouble and also its variety are determined by thorough inspection. When there exists an incomplete form, which is not unusual, the extent and situation of such can be determined only by inspection combined with examination by the finger or sound.

Of the malformations of the small intestine, there may be stenosis or atresia at any part, or at many. The commonest situation is in the duodenum. Stenosis of the small intestine is not as common as atresia, and the lumen of the bowel may be completely obliterated for a considerable distance. In such cases the intestine above the obstruction is markedly distended and that which is below is apt to be atrophied. The symptoms appear very soon after birth and they are simply those of intestinal obstruction (see index), the infant dying within one week in cases of atresia and within three months in cases of stenosis.

Meckel's diverticulum is the remains of the omphalomesenteric duct, and is given off from the ileum, about ten or twelve inches above the ileocecal valve. This usually exists as a blind pouch (one to three inches long) communicating with the intestine. There may be a fibrous cord at the end of this, free in the abdominal cavity or attached to the umbilicus, or there may be a fecal fistula. Prolapse may occur, leading to abdominal tumor with a fistula at its summit. Such tumors are usually small, but may enlarge to the size of an adult fist. They are smooth, not reducible, and have a rosy pink surface, from which there is oozing of mucus. Meckel's diverticulum may compress a coil of the intestine and lead to an obstruction or even to strangulation, and this may occur in infancy or during later life.

Malpositions are not infrequent; the ascending colon may be upon the left side of the abdomen. Most of the abdominal viscera may be transposed. The only malformations and malpositions which are of any practical importance are those of the lower portion of the intestine, the rest usually being incompatible with life.

Intussusception, or invagination of the bowel, may occur at any age, but is far more frequent during early life. Of the 50 per cent. of cases occurring before the tenth year, the first year of life claims considerably more than half. Its frequency during early life is readily explained by the greater tendency to diarrheal disorders, to free peristaltic movement, the greater amplitude of the mesentery, and the mobility of the cecum. The most noticeable symptoms are abdominal pain, spasmodic vomiting and obstinate constipation, and the formation of a tumor.

An acute intussusception may occur in a child who is apparently

in perfect health. There is a sudden attack of abdominal pain, which is very great and associated with repeated, violent vomiting. While the pain is continuous, there may be a distinct paroxysmal increase, and such is accompanied with much straining, screaming, and more or less violent kicking and tossing about. Prostration is always extreme.

At first there is usually the passage of small quantities of blood and mucus, or sometimes these are passed with the addition of very small quantities of feces. Other cases show an entire absence of any discharge from the rectum from the beginning. Quite soon after the sudden onset there is usually complete and obstinate constipation, but a few instances are reported in which bloody diarrhea persisted over a considerable period.

The most characteristic sign of the disease is the formation of a definite tumor which is palpable through the abdominal wall or by the finger in the rectum. The tumor is smooth, slightly movable, very tender, and cylindrical. In the typical cases this tumor is felt above the umbilicus, extending toward the right flank.

The presence of the tumor must be demonstrated soon after the onset, for the rapidly occurring tympanites will, within a few hours, make its detection almost impossible. After the case has progressed for twenty or more hours, rectal examination is usually the only means of detection. Then the tumor has usually advanced into the left flank, and is revealed as a congested mass with a central aperture (somewhat resembling the os uteri). Straining by the child causes this mass to advance somewhat.

The vomiting is persistent. The vomitus consists first of the contents of the stomach, then of bile mixed with mucus. The vomiting of feces in intussusception in children is rare, for before this can occur they are usually dead.

The diagnosis has to be made from all other forms of intestinal obstruction, and this is usually easy, if the cylindrical tumor of the nature described can be felt. In the absence of the tumor the differential diagnosis must be made from some forms of suppurative peritonitis, appendicitis, and obstruction from enlarged mesenteric glands, and to accomplish this it may be necessary to make an exploratory incision. (When this is done, it should be with preparation for a complete operation if conditions demand it.)

Impacted Feces.—In this condition the constipation is obstinate and the vomiting is not very violent or persistent. The occurrence of tympanites is late and collapse does not occur for several days. The feces can be readily felt as an impaction in the rectum. This impaction can be easily broken up by the finger introduced into the rectum, and with the removal of the mass there is an almost immediate relief from all the symptoms.

Strangulated hernia as a cause of obstinate constipation associated with vomiting is not very difficult of diagnosis. The local conditions are generally so marked that there is but little chance for error. The hernia is irreducible (while previously it could be readily reduced) and rapidly becomes more tense. Added to the condition is that of pain upon pressure over the protrusion. The symptoms belonging to intestinal obstructions in general are present.

The only error in diagnosis which would seem to be probable is that afforded by the strangulation of the testicle in the inguinal canal. But in this latter condition the tympanites is not marked, and is usually entirely absent, and examination of the scrotum fails to reveal the presence of the testicle in its proper position.

Pyloric Stenosis.—The vomiting in pyloric stenosis occurs even when the very smallest amounts of food are taken. The vomitus shows constantly the absence of any bile. The constipation is, of course, obstinate, but this occurs with a marked depression of the whole abdomen and a distended epigastrium. Vomiting in this condition is the earliest symptom noted, beginning within the first three days of life, as a general rule, or it may be delayed for weeks.

Usually these cases are at first treated as instances of ordinary gastric indigestion, but the character of the vomitus (without bile) should at once arouse suspicion of the true condition. After the case has advanced for a considerable time, the exaggerated peristalsis of the stomach may often be seen plainly through the abdominal walls.

DISEASES OF THE STOMACH WITH VOMITING AS A PROMINENT SYMPTOM

It is especially characteristic of the stomach that interference with its function is very liable to produce, among other symptoms, vomiting. The relationship between what we call functional disturbances and anatomical changes is not easily studied, because the postmortem changes are so rapid.

Acute Gastric Indigestion.—This disease nearly always results from too much work having been put upon the stomach. Vomiting is by far the most constant feature and occurs very early in the disease. The act of vomiting is excited by the food remaining for a long time in the stomach undigested. With the expulsion of this irritating mass the vomiting usually subsides, or, in any event, becomes markedly less severe. If such vomiting persists for more than six or seven hours, the cause is probably not one purely of indigestion, but of some associated disturbance.

The temperature shows very wide variations, but, as a rule, it ranges between 100° and 101° F.; in susceptible infants it is not at all unusual to encounter a temperature of 104° or 105° F. One characteristic of the temperature, irrespective of its height, is that it rapidly approaches the normal as the stomach is emptied, and in this particular temperature and vomiting keep pace.

In a few instances there are more or less decided nervous symptoms (as restlessness, stupor, headache, and rarely convulsions), but these are usually very mild. The course of the disease is about forty-eight hours, but rapidly occurring relapses are common—so much so as to be almost the rule. In infancy there is a marked tendency of the disturbance to extend to the intestines, and the diarrhea with stools showing the presence of undigested food, which so frequently occurs, is an evidence of such extension.

The diagnosis is made principally by the short duration, the character of the vomitus, and the relief which comes from the emptying of the stomach; also the marked tendency to relapse. From acute gastritis a diagnosis is at first impossible, unless there is a history of similar previous attacks and an exclusion of the etiologic factors of gastritis. Persistence of all the symp-

toms, and especially those of pain, vomiting, fever, and thirst, indicates the inflammatory element and suggests gastritis, and if the vomitus contains mucus tinged with blood, the diagnosis is practically positive. In questions of doubt one would naturally lean strongly toward a diagnosis of indigestion, for it is so common, while gastritis is comparatively rare in infancy and scarcely ever exists alone.

Acute Gastritis.—As has been previously stated, the onset of this disease can hardly be distinguished from acute indigestion. However, within six or seven hours, when one naturally expects the vomiting caused by acute indigestion to cease, or at least to markedly subside, there is no let up, and vomiting, temperature, and pain all remain about as severe as at first. When this occurs, it should arouse a suspicion of an inflammatory element.

The vomitus about this time will become pale in color, sometimes mixed with bile, and is sour; if mucus is present, which is streaked with blood, the diagnosis is reasonably certain. The thirst at this stage begins to be intense, and attempts to relieve it by the ingestion of fluids lead to their immediate and violent expulsion. This is a suspicious sign of inflammation.

Inspection usually shows at this time a slight puffiness of the epigastrium; upon palpation the region seems somewhat hard and tumefied. Tenderness is more or less marked, and after a few hours tends to extend to the abdomen. If the temperature is at all high, it is only so for the first twenty-four hours, and after that it is rare for it to exceed 101° F.

From the very onset the symptoms are very apt to be severe.

Preceding the attack there is usually constipation, which may give way to diarrhea. The urine is high colored, the respirations shallow and frequent, and the pulse rapid and weak.

If diarrhea is added to the symptoms to any considerable extent, it indicates an extension of the disturbance to the duodenum and small intestine. The course of the disease is usually from four to eight days, although if not properly cared for, it may persist for three weeks.

The above describes the usual form of the disease—acute catarrhal gastritis; but mention must be made of the rarer forms.

Croupous gastritis is practically a curiosity, and the diagnosis

is never made during life, unless a piece of the membrane is vomited. Generally it is a sequela to croupous inflammation of the pharynx, intestines, or esophagus, and the symptoms of the primary disease completely cover the gastritis.

Toxic gastritis results from the local action of irritants of a poisonous nature, so that for their diagnosis there must be the history of the ingestion of some such substance (this may be introduced by the sucking of painted toys, matches, etc.).

Suppurative gastritis has as its feature infiltrations of pus in the connective tissue of the stomach. It is recognized only at the autopsy.

Gastroduodenitis.—Inflammation of the duodenum may exist alone, but usually this is not so, for in most instances we find the stomach and duodenum in associated inflammation. So, then, the term gastroduodenitis seems to be the best one. However, inflammation of the duodenum may be associated with inflammation of the common bile-duct or, again, with the rest of the small intestine.

At its onset this disease (like acute gastritis) cannot be well distinguished from acute indigestion. Generally the first sign which will guide us in the diagnosis is the site of the pain. Pain is usually quite marked and localized somewhat definitely in the region of the duodenum. There is usually some associated tenderness also. The vomiting is generally very persistent for several days, and this would help to exclude the probability of acute indigestion.

Constipation is generally present. The persistence of the symptoms after the first seven hours would lead one to suspect gastritis, but although most of the symptoms are similar, the prostration is not so marked in gastroduodenitis. Nevertheless it is usually not until the third day of the disease that we have the appearance of the first symptom of real diagnostic value; this is icterus. The conjunctiva is the first situation affected, then the skin. With the onset of the icterus we have added the symptoms of an obstructive jaundice: gray or white stools, intestinal flatus, dark yellowish-green or bronze-colored urine. Itching of the skin and slow pulse, which are so common during jaundice in the adult, are very rare among children. The general symptoms

persist for about two weeks, but the jaundice may remain for several days longer, gradually subsiding.

Chronic Gastric Indigestion; Gastric Catarrh; Chronic Gastritis.—Clinically, all these diseases are so nearly identical that there is no practical advantage in considering them separately. Taking them collectively, the chief difference in their symptomatology is determined by the age of the child.

In infancy the one constant characteristic of all three is the vomiting. This takes place without regard to the time of the ingestion of food, some infants vomiting soon after the meal, while others vomit at protracted intervals. The vomitus consists of food (often that which has been in the stomach for seven or eight hours) and large quantities (often an ounce) of mucus. The stomach retains the food several hours longer than is normal, and this is well illustrated by stomach-washing. The failure of digestion is attested by the presence of undigested food in the stools.

As a general thing, anorexia is very marked and the tongue is heavily coated. Of course, signs of general malnutrition are always present (anemia, restlessness, loss of weight, arrested development, etc.), and there is some bowel derangement, usually diarrhea. Low toxic symptoms are not uncommon, affecting both physical and mental development. The diseases run an indefinite course, with little tendency to spontaneous recovery.

In older children vomiting is still the characteristic symptom, but it is not so persistent or so frequent as in infancy. It generally occurs shortly after one or more of the meals. Between the attacks of vomiting there is apt to be considerable regurgitation of small particles of food and an acid fluid. The appetite is very fickle and there may be epigastric tenderness. Malnutrition with its host of consequent symptoms completes the symptomatology. Generally it is possible to demonstrate a slight degree of dilatation. On account of the relaxed and congested condition of the mucous membranes of the throat, there is apt to be an obstinate cough.

Dilatation of the Stomach.—So long as the motility of the stomach is but slightly affected, there are few consequences; but should the lack of action be so pronounced that particles of food remain constantly in the organ, fermentation results, which tends to

distend the muscle; thus dilatation may be produced. Usually motor insufficiency and dilatation are associated, but this is not essential. Dilatation may arise from a variety of causes, as mechanical stenosis of the pylorus, anomalies in form and position of the organ, fermentation, and atony.

Dilatation is commonly seen during infancy, as a somewhat temporary feature of all the gastric derangements. Permanent dilatation usually follows repeated attacks of these disorders. The only reasonable way to diagnose such a condition is by percussion, filling the organ with gas or fluid not being justifiable in infancy. If percussion is carefully performed two or three hours after a meal, one can generally demonstrate a tympanitic note extending down to, or even below, the umbilicus. In older children this may be corroborated by filling the stomach with fluid and again percussing over the same area which has been previously marked.

Dilatation of the transverse colon may be mistaken for dilatation of the stomach, but in the former the lower outline is slightly concave, while in the latter it is strongly convex. Degrees of dilatation are determined by using measured quantities of fluid in the stomach.

CHARACTER OF THE VOMITUS

Blood.—The blood may be simply streaked through the vomitus or it may compose the greater part of it. The first consideration would naturally be to determine beyond all possibility of doubt that blood is actually present in the vomitus, and it is easy to be deceived in this regard. There are several articles which, ingested, cause vomiting and exhibit a vomitus which is deceptive, so that in every case where there is the remotest chance for doubt, an examination should be made by the microscope to determine the presence of blood-corpuscles.

Having determined that blood is actually present in the vomitus, there remains still another element of doubt: Does the blood come from the stomach? That is, a false condition must not be confounded with a true hematemesis. In the course of the former the amount of blood in the vomitus is usually small, so that there are no associated general symptoms depending upon the amount

of the hemorrhage, and its source is generally easily discovered. In the latter (true hematemesis) constitutional symptoms are almost invariably associated and the child's health has suffered in proportion to the severity and persistency of the trouble.

The most frequent cause of the false condition is epistaxis, and this is especially true of older children. If nose-bleed occurs while the child is in the prone position, the blood is very apt to be swallowed and subsequently vomited. The nose should be examined to determine the possible source of the hemorrhage, and if from the nose, clotted blood will readily be detected. If any cause within the nose is excluded, then the possibility of an acute esophagitis must be determined.

It is somewhat rare that a fissured nipple is the source of the blood which an infant may vomit, for such blood is seldom swallowed, but still it is a possibility which must be remembered. It is quite common that the violence of an attack of vomiting will cause some blood to be streaked through the vomitus. In debilitated children of all ages there may be a general lack of tone to all of the mucous membranes, and the stomach does not escape, so that hemorrhage may occur from very slight causes.

Hematemesis is not a usual occurrence in young children, because the common causes of hemorrhage from the stomach do not exist so generally in that period of life. In older children the most common cause of hematemesis is purpura hæmorrhagica, and the clinical picture of this disease is so marked that there would be no probability of any error arising as to the cause of the hemorrhage.

Occasionally blood is vomited during the course of scurvy, but when it occurs, it is at a stage of the disease in which the cause is easily recognized. Ulcers of the stomach are rare in childhood, and when they occur, the symptoms are rather indefinite. Before perforation occurs, about the only symptoms present are gastric pain and tenderness, bloody stools, and the vomiting of blood. Rubeola and variola of the hemorrhagic types often have vomiting of blood as an early symptom, and the diagnosis must be made by a consideration of all of the diagnostic points of the disease with which the hemorrhages are associated.

Hemorrhagic disease of the newly born has as its marked feature hemorrhages from various organs and tissues, and the stomach

is no exception to the involvement. Hemorrhages take place, as a rule, about the third day of life, and in no instance later than the twelfth. General malnutrition and hereditary syphilis tend to promote hemorrhage from any mucous membrane from slight causes, so that they may be responsible for hematemesis.

Food.—The food taken is usually vomited after several feedings in cases of acute inanition and dilatation of the stomach. The vomiting which occurs in pyloric stenosis is usually within a very short time of the meal and the food is unchanged; bile is absent. Vomiting of the food, which is but partly digested and is very sour, occurs in acute gastritis more often than in other conditions. Ejection of the food directly after a coughing spell points to pertussis, or in rarer instances may be due to the violence of the coughing.

Uncoagulated Milk.—The return of uncoagulated milk from the stomach of infants may be due to the formation of a vomiting habit, and if so, is apt to be accompanied by facial grimaces. The more common causes are violent motion at any time within twenty minutes of the meal or pressure over the abdomen. Overfeeding is a prolific cause of such vomitus appearing.

If the food has been retained for over twenty minutes and is then returned uncoagulated, it is evidence of a lack of sufficient acid in the stomach; if hyperacidity is present, coagulated milk will be expelled quickly after its ingestion. In marasmus the milk (or other food) is vomited almost as soon as it has been taken.

Food and Mucus.—In determining that mucus from the stomach is present in the vomitus care must be taken to exclude the swallowing of mucus and its subsequent ejection with the food. Mucus is most apt to be vomited with the food in dilatation of the stomach and chronic gastric indigestion, gastric catarrh, chronic gastritis, in the last three of which the amount of mucus is usually very large. In infancy the amount may be one ounce.

Food and Bile.—In acute intussusception the contents of the stomach are first violently ejected, and this is followed very shortly by the vomiting of bile. Fecal vomiting is rare in childhood.

Pus.—Pus may be vomited as the result of swallowing the contents of an abscess, and this should be thought of at once.

Membrane.—When a membrane is vomited, it should at once

be examined microscopically to determine its nature. One must, of necessity, exclude the possibility of the swallowing of a membrane from an existing acute esophagitis. Croupous gastritis may be the source of the membrane, and vomiting of a membrane is the only thing which happens during life to aid us in the diagnosis of the disease. This disease is so rare that it is practically a curiosity.

HEMORRHAGE FROM THE STOMACH

The most common variety of hemorrhage from the stomach is that which is seen in the newly born and which is the result of hemorrhagic disease of the newly born. Such hemorrhage begins during the first three days of life, as a rule, and never after the twelfth day.

When the blood is vomited, its appearance depends upon the length of time that it has remained in the stomach, bright red blood indicating a very recent hemorrhage, and the vomiting of dark-brown masses, which is the usual occurrence, indicating more remote bleeding. The quantity varies from very small amounts up to one ounce.

In debilitated children of all ages the mucous membrane of the stomach may become eroded and result in the vomiting of blood or blood-streaked mucus. Autopsy is the only means of determining the existence of this cause of bloody vomiting.

Hematemesis may occur in hemophilia, purpura, or scurvy, and occasionally it occurs during the course of hemorrhagic rubeola and hemorrhagic variola.

There may be no symptoms except those of an internal hemorrhage, but that is exceedingly rare. The mere presence of the blood in the stomach almost invariably excites vomiting, so that to avoid repetition the causes and diagnosis are considered in detail in the section on "Character of the Vomitus." The object of this short section is to impress the fact that, although rare, hemorrhage may occur without vomiting.

ABDOMINAL PAIN

It requires considerable judgment to give abdominal pain in the child its proper significance. In the examination of the older child it is necessary to determine at the outset whether or not the pain is limited to the abdominal wall, or if it is associated with one of the underlying viscera.

While it is not very common, at the same time it is not infrequent that we find the wall of the abdomen hyperesthesic. The result is that in the examination to determine the site of any abdominal pain the inner aspect of the thighs should be first examined. In doing this we gain two things: first, we do not directly approach the site of expressed pain, and we thereby gain the child's confidence somewhat; and, second, hyperesthesia of the abdominal wall is almost invariably associated with a similar condition of the inner aspect of the thighs, and absence in this situation would lead one to suspect its absence in the abdomen.

When such hyperesthesia is present, it is spread over a somewhat considerable area, extending well up over the chest. If a fold of the skin is grasped and firm pressure is made upon it, the pain is increased in proportion to the degree of pressure. Hyperesthesia of the skin of the abdomen is fairly constantly associated with typhoid fever and meningitis; less frequently with malaria, the acute infectious diseases, and anemia.

Sometimes we find that the pain is simply muscular, and the causes of such a condition are usually exposure to cold, straining from violent coughing, unusual exercises involving the abdominal musculature, and in rare instances rheumatism. In all such cases the pain is localized quite strictly to the recti muscles if the active cause is a mild one.

However, if the condition is of the unusual severe type, there may be vomiting, some fever, and rather wide-spread abdominal pain, which compels the child to assume one position and remain

in it. The whole course of the severest attacks is not over forty-eight hours. In nearly every instance exercise is the cause of the severe attacks.

If the pain is due to inflammation of the peritoneum, it is by far the most acute abdominal pain which is observed. It is continuous, although this fact may be overlooked, owing to the acute exacerbations which occur and which are due to peristalsis. Associated with the pain there is tension of the abdominal wall, the slightest pressure increases the pain markedly, and there are the other evidences of inflammation of the peritoneum, as tympanites, constipation, etc.

Fig. 22.—Abdominal pain, general and colicky. Indicative of intestinal colic, intestinal obstruction, intestinal perforation, the onset of appendicitis, peritonitis, vertebral disease, pneumonia (frequently prominent), rheumatism of abdominal muscles, overexertion.

Intestinal Colic.—This is one of the most frequent causes of pain and crying in infants. They not only cry, but usually there is a succession of shrieks, which is associated with throwing about of the legs, until relief comes with the expulsion of flatus. Generally such attacks are associated with constipation, but this is not always the case, as they not infrequently are associated with diarrhea. A valued aid in the rapid recognition of this condition is the fact of the quick relief which is afforded by the use of a warm enema.

By far the chief seat of conditions which result in attacks of intestinal colic is the stomach, and failure of perfect digestion in that organ is almost certain to be followed by colic. Intestinal parasites are a less frequent cause, as is also loss of tone of the muscular walls of the intestines.

The abdomen is generally much distended with gas, and if there is an absence of this feature, the search for the cause should be

most thorough, and it ought not to be accepted as a simple intestinal colic until every other possible cause is excluded. It is characteristic of the condition that after the subsidence of the attack there is an entire absence of all ill effects.

Intestinal colic is most frequent during the first six months of life, and irrespective of the fact as to whether the infant is breast-fed or bottle-fed. Perhaps it would be no exaggeration to say that fully three-quarters of all the cases are due to the proteid element in the food.

In the diagnosis of the condition one must be certain that the attacks are acute, for a chronic state of flatulence in an infant may be associated with more or less wasting and slight fever, and would suggest the probability of a beginning tuberculous

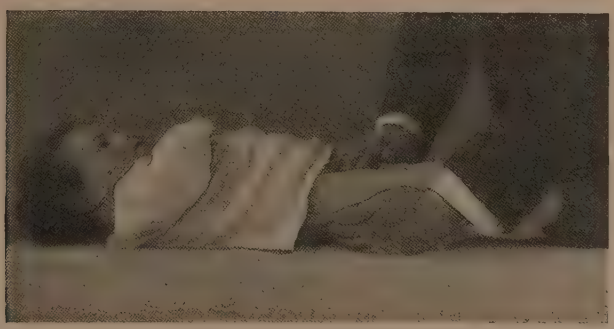

Fig. 23.—Palpating the appendix.

peritonitis. If there is an elevation of the evening temperature and a well-defined tenderness of the abdomen, with various points at which there is evident thickening, then the diagnosis of tuberculous peritonitis is almost certain.

Appendicitis.—There are three cardinal symptoms of this disease—localized abdominal pain, localized abdominal tenderness, and rigidity of the right recti muscles.

Of the three, the first is the least important in diagnosis, for it may be slight. Usually, however, pain is severe and intermittent, so that the child complains as of colic. The child (unless of much intelligence and over six or seven years of age) exhibits its usual inability to definitely locate the pain, and in most instances when it is somewhat definitely located, it is referred to the umbilicus.

Tenderness is a much more constant feature and is seldom, if ever, absent. By palpation it is located in the right inguinal region, but the whole abdomen may be hyperesthesic. Even in this case there is more acute tenderness in the right inguinal region.

Muscular rigidity is the last-mentioned and yet the most valuable sign of the three, for it is never wanting in some degree. It is particularly marked in the lower quadrant on the right side.

Rise of temperature may be moderate or there may be considerable pyrexia, the usual ranges being between 100° and 104° F. It must be remembered, however, that the height of the fever is no indication of the severity of the disease. Associated with the fever there is generally more or less vomiting, which is usually repeated, and may persist until it becomes first bilious, then fecal (the latter being very rare).

In contrast to the usually low temperature, the pulse is characteristically rapid and is often thin and thready. Thirst, which is marked, and constipation, which is obstinate, are the rule, although the attack may at times be preceded by diarrhea. The child usually assumes a dorsal position with the right limb flexed at the hip and the knee. The termination of the disease is by resolution, the development of general peritonitis, or the formation of an abscess.

An attack of appendicitis is usually sudden, and the acute catarrhal type may subside within forty-eight hours and fail to be recognized. However, if all cases of supposed acute attacks of indigestion were examined after a subsidence of all symptoms, in many instances a careful palpation would reveal a slight thickening and induration about the region of the appendix, and the true nature of the attacks would thus be discovered.

It is not unusual for several such attacks to occur within a few months or years, and in every instance be attributed to some error in diet. The value in recognizing such attacks is in advising appropriate measures for the prevention of a severe suppurative form of the disease, which is liable to appear at any time, either during the course of one of the mild attacks or directly after it.

If an abscess is formed, then this is recognized by the boggy feel of the tumor and exploration by the fingers through the rectum, or in rare instances it may be justifiable to use the exploring

needle to aspirate the pus. Symptoms which are strongly suggestive of an abscess are fluctuating fever (with the history of chills in older children), a persistently coated and furred tongue, and increasing prostration.

The value of a blood-count is doubtful in children. Such a count requires the most careful technic, and to avoid error there must be several counts daily, and if the pus become encysted, the count is of lessened value. For practical general work it is useless.

When an abscess has developed, the course of such is very indefinite, sometimes persisting with symptoms of a mild septicemia for weeks. It is very rare that severe symptoms are persistent for a considerable period. Peritonitis sometimes will develop upon the third or fourth day, and usually collapse and death quickly follow in such cases.

The symptoms which are most suggestive of such an extension are an otherwise unexplained rise in the temperature, abdominal distention, rather sudden subsidence of the localized pain, to be followed shortly by generalized abdominal pain, tympanites, and collapse.

The diagnosis must be made first from acute indigestion, which usually exhibits a higher temperature and much more rapid subsidence of the acute symptoms, and which exhibits no thickening in the region of the appendix when palpation is later practised.

From volvulus and intussusception the diagnosis is usually readily made, for in these conditions there is absence of the temperature rise, and there is present the passage of bloody stools or mucous discharges from the rectum which are accompanied with tenesmus and the development of a left-sided tumor, as a rule. The tympanites may be so early in appearance and so marked in degree that the tumor cannot be made out.

Nephritic colic may simulate appendicitis for a time, but the pain is limited to the lumbar region, and instead of increasing is decreased by pressure. The pain generally radiates along the course of the ureter and is relieved to an extent by urination. There is no muscular rigidity of the abdomen. Slight fever may be present, but this is unusual.

Hepatic colic sometimes has a most acute onset with severe

pain and vomiting and may simulate appendicitis, but the pain is more severe and persistent in character and confined mostly to the lower portion of the right side of the chest. Typhoid fever is sometimes hard to differentiate, particularly when the history is vague and the symptoms are not pronounced. It is then necessary to delay judgment or apply the Widal test.

Pneumonia of the right lower lobe may have an onset much like appendicitis, and with a similar abdominal pain, which is due to involvement of the lower dorsal nerves, so that it is necessary to carefully examine the chest to distinguish the real disease. The symptoms which would suggest a lung condition are: sudden rise of temperature to 103° F. or over and its maintenance about that point, increased respirations (out of proportion to pulse), relaxed abdominal muscles, and cough.

Acute Peritonitis.—This disease is usually easy to recognize, on account of the well-defined symptoms, chief of which is severe and diffused abdominal pain. This pain is increased by the slightest degree of pressure, so that the motion of the child, coughing, sneezing, or jarring the bed will increase the suffering greatly. The result is that the child remains immobile upon the back with the legs drawn up to relieve the tension on the abdominal muscles.

The onset is nearly always quite abrupt, with vomiting and rise of temperature, the vomiting being usually present only at the onset and the temperature reaching 103° or 105° F. The most constant feature of the disease is the swollen and tympanitic abdomen. The distention is diffuse in nearly every instance, but rarely it may not be so regular. Constipation is the rule.

Outside of the local symptoms, there is evidence, from the general ones, of the seriousness of the disease. From the very start prostration is very marked and the pulse is weak and small. The pain is evidenced by the drawn and pinched features, and the extremities are in some cases cold and clammy. The mind is usually clear. When the vomiting persists, it is generally an indication that collapse will quickly supervene.

In childhood the course of the disease is usually rapid (three or four days), but if of a moderate severity, the course may be ten days, and after that time there is generally a localization of the

process with good chances for recovery. If peritoneal abscess develops, then we have the added symptoms of hectic temperature, chills, sweating, and local signs of tumor.

In young infants the disease is not so well defined and therefore is harder to distinguish. In them it usually proves fatal within the first seventy-two hours, and with symptoms so obscure that often the diagnosis is not made. The pain is evidenced by the restlessness, the constant crying, and fretfulness. In most cases the diagnosis is not made unless there has been a clear history of some etiologic factor. In the newly born this might be by direct infection through the umbilical vessels; in older infants by traumatism, severe burns, or as a secondary condition to appendicitis, hepatic abscess, acute intestinal obstruction, pleuritis, gonorrheal vulvovaginitis, pneumonia, or scarlet fever.

Catarrh of the Small Intestine.—This may produce colic, and if so, the pain usually immediately precedes a diarrheal stool and relief is coincident with the movement.

Catarrh of the large intestine is accompanied by frequent colicky pains which are associated with tenesmus and stools which are composed mostly of mucus.

Intussusception exhibits a most intense abdominal pain, and this is discussed on page 113.

Intestinal Parasites.—These may be suspected as the cause of colic if the pain occur early in the day upon an empty stomach, but the only positive diagnosis is made by their removal resulting in an entire subsidence of all the symptoms.

Spinal Caries.—The pain is usually worse at night and is referred to those parts of the abdomen which are the site of the distribution of the nerves which are nearest the site of the spinal lesion.

Nephritic Colic.—There is usually a distinct family history or history of previous attacks, and it follows exercise, as a rule.

EXAMINATION OF THE ABDOMEN

Inspection.—This should note, first of all, the general condition of the abdominal wall. Thin walls are due to absence of adipose tissue or to deficient muscular development, and are associated with conditions of malnutrition or those which cause intra-abdominal pressure. On the other hand, a thickened abdominal wall is due to edema or to excess of adipose tissue.

The skin should be smooth and of a color corresponding to the rest of the covered portions of the body (except about the navel,

Fig. 24.—Rectal bimanual examination. Finger of one hand is introduced well up into the rectum, while the other hand is free to manipulate the lower abdomen.

where it is slightly darker) and the superficial veins should not be prominent. If veins are prominent, it indicates some interference with free circulation in the inferior vena cava.

The navel should be entirely healed in infants within two weeks of birth, and should not show any signs of inflammation. As a rule, the remnants of the cord separate on the fifth day, and separation occurs without appreciable odor (which, if present, indicates infection). Bleeding from the navel may be of two kinds: it may be due to a poorly adjusted ligature or to a consti-

tutional condition, as hemophilia, hereditary syphilis, or the hemorrhagic disease of the newly born. In all these conditions, which are general, there is associated hemorrhage from other organs and parts of the body, and the diagnosis of each must be made by the consideration of all accompanying symptoms.

Protrusion of the navel may be due to superabundant skin (in which case the protrusion is conical and irreducible) or may be due to hernia, and if the latter, then the shape is somewhat spherical (unless the protrusion is large, when it may be conical), the size is increased by crying, and the tumor is readily reduced. Rarely we encounter the umbilicus fungus, which is about the size of a small pea, is pediculated, and bleeds readily under the slightest interference, being readily recognized by these qualities.

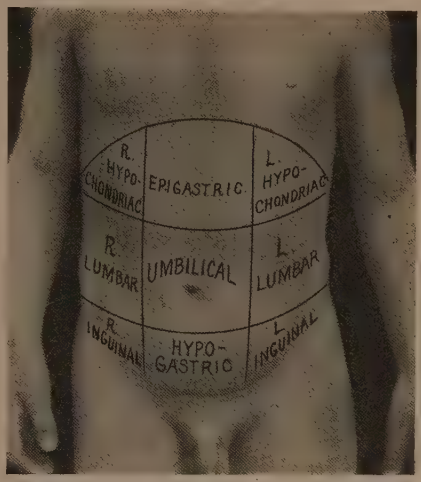

Fig. 25.—The abdominal regions. The heavy line at the upper border shows the extreme limit of the diaphragm. Imaginary lines divide the abdomen into different regions which, for the sake of clearness and precision, are known as the right and left hypochondriac, the epigastric, the right and left lumbar, the umbilical, the right and left inguinal, the hypogastric.

Respiratory movements must be noted, and their absence suggests some painful condition in the abdomen, if collapse be excluded. Rigidity usually accompanies painful conditions. The movements are exaggerated in most conditions which cause an interference with free respiration, and respiratory retraction of the abdomen is usually very marked in laryngeal stenosis.

Under normal conditions the wall of the abdomen seems to be upon a level with the lower wall of the chest when the child is in a recumbent position. If below that level, then the abdomen may be said to be retracted, but this condition is of slight diagnostic value unless associated with other symptoms, for it occurs in conditions in which there is much body waste, and especially

during those diseases in which vomiting and diarrhea are persistent. A retracted abdomen associated with constipation and fever of a typhoid type is at once suggestive of tuberculous meningitis, and if, in addition, the fever is low and the child somnolent, the diagnosis is almost certain.

Omphalitis.—This may develop in three days after birth or may be delayed for as many weeks. The tissues about the umbilicus become first reddened, then swollen and painful, and there may be added some slight constitutional symptoms (which latter indicate that the inflammation has involved the umbilical vessels). The condition may remain localized, or spread and result in general sepsis.

Palpation.—This procedure must be very gently performed,

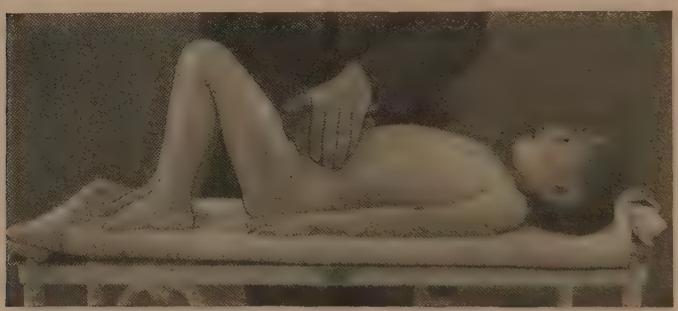

Fig. 26.—Examination of the abdomen by one hand reinforcing the other. Such an examination is rarely necessary during childhood.

and with the warmed hand until the child's confidence is somewhat gained, then the examination may be more firm, but still gentle. Palpation should be made by performing circular movements over the part to be examined, and while this is being done, the child's attention should be diverted from the examination as much as possible. This is best accomplished by a story, for the usual method of using a toy generally results in muscular effort, which is undesirable, and when such effort involves the abdominal musculature, the object of the diversion, of course, is defeated. A change of position, and especially flexure of the legs, will aid in securing an increased degree of relaxation.

The method of reinforced pressure (one hand aiding the other), which is so useful in adults, is rarely necessary in the examination

of children, and the same might be said of the use of anesthetics to secure relaxation; it is rarely needed. Normally, the child's abdomen has the feel of an elastic cushion which is moderately inflated with air, but there is one exception to this, and that is during the first month of life, when the liver and spleen are readily palpated.

In performing palpation of the viscera it is well to remember that it is much easier to palpate the border of an organ than its surface. So, then, in palpating the abdominal viscera, it is best to begin a little below the organ and palpate upward during inspiration, if possible.

ENLARGEMENT OF THE ABDOMEN

The size of the abdomen varies in different children, and this is due partly to the amount of adipose tissue present, partly to the size of the intestines and the age of the child. In infants and young children the abdomen is slightly more protuberant than in later life. However, allowing for these differences, enlarged abdomen may be said to exist if, while the child is recumbent upon a fairly firm surface, the abdominal wall lies above the level of the lower wall of the chest. This is simply a general statement, and allowance must be made in the case of thin children, for in that instance one would not expect the level of the abdomen and the lower chest wall to correspond; the abdominal wall would be slightly below the chest level.

The best way to determine the cause of the enlargement would be to first of all eliminate both of the most frequent causes of enlarged abdomen in children, and these are tympanites and ascites.

Tympanites.—This may have one of two ways of developing—acutely or chronically.

Acute development with moderate distention occurs very frequently during infancy, and is in most instances due to acute catarrh of the small intestines, gastric or intestinal indigestion, or constipation. It is commonly associated with all the diseases of infancy in which the digestive conditions are at all disturbed.

The acute form with marked distention has an entirely different

meaning, and is usually associated with the more serious diseases of children. It is a part of the symptom group in peritonitis, intussusception, and intestinal obstruction from any cause.

Chronic tympanites is usually present in all the chronic intestinal disorders to a greater or less degree, and there are quite distinct periods of exacerbation. Occurring in rachitis and marasmus, the tympanites is much more constant, while in chronic peritonitis the course is progressive.

In children with poorly developed muscles the degree of tympanites which may occur from any given cause is greater than occurs in children whose general musculature is well developed. It is not difficult to recognize enlargement due to tympanites, because the abdomen is tympanitic everywhere upon percussion.

Fig. 27.—Testing for fluid in the abdominal cavity.

If the abdominal wall is very tense, then the tympanitic note is more marked and the area is enlarged.

Ascites.—This is an accumulation of fluid in the peritoneal cavity, and if it is large and rapidly developed, the abdomen is barrel-shaped and change of position does not alter its shape; but if the development is slow and the accumulation less large, the abdomen is flattened at the top and bulging at the sides when the child is recumbent. If the position is changed, the shape of the abdomen also is altered. In an uncomplicated ascites the surface of the abdomen is smooth.

Upon palpation fluctuation is detected if the following procedure is observed: Place the left hand firmly against one side of the

abdomen, and with the right hand the abdomen is lightly tapped on the side opposite to the left hand. The best points are at the

Fig. 28.—Illustrating the lateral dull areas and the central tympanitic area which is evident when the abdomen contains free fluid.

level of the fluid, and to determine this it is well to commence low down and work upward toward the median line. If the abdomen

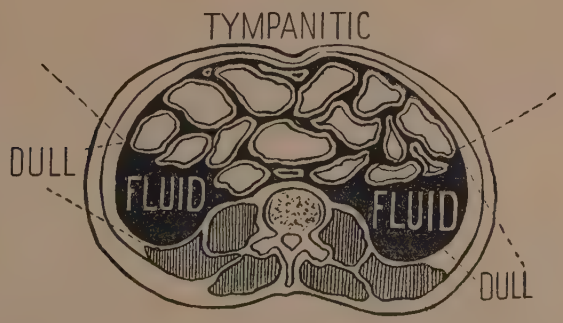

Fig. 29.—Diagram illustrating bilateral flank dullness when free fluid is in the abdomen and the child is in a dorsal posture.

is very tense from gas, false fluctuation may be obtained, but this is differentiated by the very small wave which is produced in a very tense abdomen. Percussion gives dullness over the site of

the fluid, and naturally a change of position resulting in a change in the situation of the fluid causes the dullness to vary.

The subjective symptoms are due to mechanical pressure, plus those which are dependent upon the cause of the ascites. It is quite important that ascites should not be confounded with the conditions which cause accumulation of fluid in organs or sacs, as is observed in hydronephrosis, distended bladder, or ovarian cyst.

Hydronephrosis.—This is due to some obstruction to the free flow of the urine, either in the ureter, the bladder, or the urethra, and the resulting distention of the ureter or renal pelvis. It may be unilateral or bilateral, congenital or acquired. It is not necessary for its production that the retention of the urine be

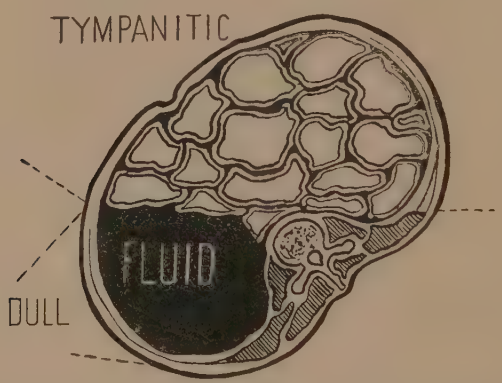

Fig. 30.—Diagram illustrating that when free fluid is in the abdomen, a laterodorsal posture results in the upper flank being tympanitic, while the area of dullness in the lower flank is increased.

complete, for the amount or degree of retention depends largely upon the nature of the obstruction. Usually there is a distention of the whole of the urinary tract above the site of the obstruction.

The symptoms (other than tumor) are exceedingly variable and may be absent, so that the diagnosis is generally made from the presence of an abdominal tumor. This tumor is spherical, fluctuating, and smooth, and intimately connected with the kidney. If the tumor is unilateral, then the diagnosis is comparatively easy, for there is unilateral bulging and flatness upon percussion, and the connection with the kidney can usually be well mapped out; but if bilateral, then the diagnosis is not easy. Puncture yields a transparent fluid which contains urea and uric acid.

There is a rare condition which may closely simulate hydronephrosis, and that is the tumor which is sometimes seen in echinococcus of the kidney. If this latter condition exists, then the aspirated fluid shows absence of the usual urinary constituents and the presence of the "hooklets" which are peculiar to echinococcus.

Fig. 31.—Illustrating the lateral tympanitic areas and the dull central area caused by cystic or solid tumor of the abdomen.

Large ovarian tumors are more likely to be mistaken for hydronephrosis, although they are quite rare. These cysts of the ovary are spherical, smooth, and fluctuating, but they arise in the false pelvis. They occupy the region of the umbilicus and the hypogastrium, while the lateral portions of the back are free from tumor.

Distended bladder is easily differentiated, for it occupies a more central and low position in the pelvis, and catheterization results in the immediate reduction of the tumor.

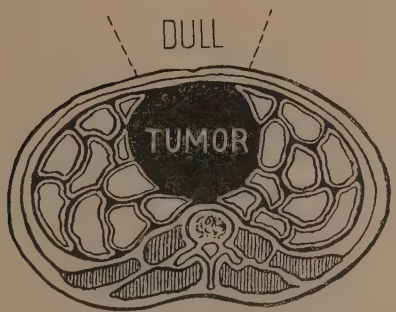

Fig. 32.—Diagram explanatory of central dullness and lateral tympanicity in cystic or solid abdominal tumors.

Distended Bladder.—If the abdominal walls are nearly normal, the tumor which results from distended bladder is easily mapped out. But at times there are conditions in the abdomen or its walls which make such a procedure impossible or difficult, and then dependence must be placed upon other signs. If upon percussion we obtain a dull sound in the median line and between the symphysis pubis and the umbili-

cus, and this dull sound extends symmetrically upon both sides of the median line, we are practically certain that there is a distention of the bladder. There is no change of the sound with a change in the position of the child. The means of positive diagnosis is the use of the catheter, for in distended bladder its use results in immediate reduction of the tumor.

Chronic (Non-tuberculous) Peritonitis.—This is a very rare condition, and its diagnosis must be guardedly made, for the tuberculous form of chronic peritonitis is so common in comparison. It occurs in children who are entirely free from tuberculous taint, and there is always a definite history of some etiologic factor, as chilling of the abdomen, occurrence of some acute infectious disease, new-growths, or injury in the abdomen.

Generally the first thing noticed is the enlargement of the abdomen, although this may be preceded by a group of very indefinite symptoms which have been so slight as to pass almost unnoticed until recalled by the taking of the history. The enlargement is gradual and the abdomen assumes within a few weeks a spherical form, the walls remaining somewhat lax. There may be some tension, but it is always slight, and upon pressure there is no tenderness or areas of hardening or thickening in the abdominal wall.

While this enlargement is going on, the general condition of the child remains good, and for several months there may be no appreciable change in the general nutrition. If fever has been noted at all, it is only in the beginning of the disease and not thereafter. In the examination of the abdomen fluctuation is easily detected, and the dull sound upon percussion always occupies the more dependent portions.

The usual course of the condition is to reach a certain maximum point of development and then to remain quiescent for an indefinite period, with subsequent absorption giving permanent relief. Relapses may occur.

Tuberculous Peritonitis.—This is usually a local expression of a general infection, but it may be primary, although this latter is rare. Some authors describe various forms of the disease, and these descriptions are based upon the location of the lesion and the changes which the parts undergo, but for practical purposes

of diagnosis it is only necessary to recognize two forms of the disease—that which is plastic and that which is associated with ascites.

The latter generally develops in a child who is in chronically poor physical condition; a child who is the subject of eczema, glandular enlargements, or has a family history of tuberculosis. Sometimes there is a preceding chronic diarrhea, or perhaps a condition of alternating diarrhea and constipation with indefinite abdominal pain which has led to the suspicion of some intestinal digestive disorder.

With the enlargement of the abdomen which takes place (there is considerable abdominal tension, with compression at the sides, so that the abdomen is not spherical in shape, but more oval) there is little fever, only a moderate amount of general weakness and malaise, and slight loss of weight. The enlargement of the abdomen is the chief feature, as a rule.

In childhood, any chronic ascites which is associated with even a very moderate fever should be considered as tuberculous until it can be proved otherwise. The diagnosis must not consider as very important the absence of cough or the general symptoms of tuberculosis, as they are usually observed in children, for tuberculous peritonitis may develop very insidiously. It cannot be too often repeated that the chest is not always the favorite site of tuberculosis in children, but that the peritoneum and meninges are very susceptible.

Between the tuberculous and the non-tuberculous forms of peritonitis there is considerable difficulty in diagnosis at first. If there is no family history of tuberculosis and no signs of tuberculosis in the lungs or any part of the body, it proves nothing against the existence of tuberculous peritonitis; if any of these are present, however, it is indicative of tuberculous infection of the peritoneum.

If there is no abdominal tenderness anywhere and careful examination does not reveal any nodular tumors or points of thickening in the abdominal wall; if the enlargement is excessive and the child's general condition is not suffering to any marked extent, it is suggestive of the non-tuberculous type of peritonitis.

As the disease progresses, then, the diagnosis becomes com-

paratively easy; the abdomen is considerably increased in size, partly from gas and partly from fluid, and the result is that the abdominal walls are tense, the umbilicus prominent, the cutaneous veins distended over the abdomen, and soreness is complained of.

There are one or more areas in the abdomen in which induration is detected with well-defined borders, and pressure over these points is painful. The induration may be well enough developed to constitute a well-defined tumor which is nodular.

The child at this later stage of the disease shows unmistakable signs of the seriousness of the disease, and there is generally a well-marked wasting, which is most noticeable in the chest, neck, and limbs. The wasting and the associated enlarged abdomen give a contrast which is most noticeable.

The temperature is about normal in the morning, but elevated in the evenings, although for no apparent reason it may be normal persistently for three or four days at a time during the course of the disease, and if this possibility is not remembered, there is a chance for erroneous conclusions.

The main points to recall in the diagnosis are that it is commoner in children than one is usually led to suppose, that the onset is insidious as a rule, that it is the chief cause of ascites in children with moderate fever, and that while the presence of tuberculous processes in other parts of the body is strongly confirmative, absence of such does not exclude the disease.

Cirrhosis of the liver must be excluded as a cause. Ascites in cirrhosis of the liver usually comes as a late symptom, and indicates the seriousness of the case. Icterus is more or less prominent, and the history usually is corroborative. However, it may be necessary to examine some of the fluid to definitely determine the cause.

The plastic form is here considered, not because it results in any considerable abdominal enlargement, but because of the importance of the recognition of tuberculous peritonitis of any form. In this type the abdomen is generally flat or may be slightly distended, but distention is mostly due to gas and not to fluid. If palpation is thoroughly performed, it is usually possible to detect several nodules or enlarged glands, matted omentum, or

viscera, or, with the finger in the rectum, tuberculous masses and bands may be felt in the lower bowel.

This form is recognized by the presence of the above-mentioned signs, associated with chronicity and very noticeable wasting and fever. Corroborative evidence would naturally be offered if one were able to demonstrate a tuberculous infection in some other part of the body.

Malignant Tumors of the Kidney.—The great majority of tumors of the kidneys in children are sarcomata, and of all of the malignant abdominal tumors, sarcoma of the kidney is the most common. Generally, the tumors are atypical, so that they are often classed as teratomata, in some cases being of a cystic or

Fig. 33.—Sarcoma of both kidneys in a male child, two years old. The tumors are outlined to show their extent (Napier).

adenomatous type, but still malignant, or they may combine some of the features of sarcoma with some of carcinoma. But whatever their nature, they grow rapidly and sometimes are so soft that they may be mistaken for chronic abscess.

The tumor is usually the first thing noticed, and the commonest situation is in the loin at first, whence it seems to grow rapidly forward toward the median line. The surface of the tumor may be quite smooth, irregular or lobulated, and the growth is so rapid that within three or four months from its discovery the tumor may almost completely fill the abdomen. When the tumor is small, its connection with the kidney can generally be easily mapped out.

Hematuria is a frequent symptom, and in a small number of cases has been observed as the first symptom, but this is unusual, for it is generally of late occurrence. The amount of blood may be large, but in most instances it is small, and so small that it is not appreciable to the unaided eye.

Pain is a rare and always a late symptom. When the tumor is of considerable size, the general symptoms (cachexia and steady wasting) first show themselves. Pressure symptoms depend upon the size and situation of the tumor.

Fig. 34.—Sarcoma of both kidneys in a male child two years of age. The tumors are here outlined to show their extent (Napier).

There is usually no difficulty in the diagnosis, the age of the child (under five years), the attachment of the tumor (to the kidney), the rapid growth (filling the abdomen in three or four months), and the character of the tumor usually being sufficiently pronounced to distinguish it. Still, malignant tumor may be mistaken for hydronephrosis, and exploratory puncture may be necessary, which in the latter disease would yield fluid with urinary constituents, and in malignant tumor would prove negative in nearly every instance. The needle is best inserted halfway between the last rib and the crest of the ilium, three inches from the spine. If the hydronephrosis depends upon some traumatism, then there is the history of an injury associated with hematuria, and later the development of a tumor which on puncture yields a clear urinous fluid.

Ovarian cysts must be differentiated by a bimanual examination through the rectum and abdomen, and this is best done under

anesthesia. If the ovarian tumor be large, then it is spherical, smooth, and fluctuating, and occupies the umbilical region and the hypogastrium, the lateral parts of the back remaining free. Retroperitoneal sarcoma and tumors of the abdominal wall must also be distinguished, and these are considered later (see the following).

Retroperitoneal Sarcoma.—This may be an irregular tumor of large dimensions, and is felt in the lower portion of the abdomen, or sometimes in its lateral portions between the crest of the

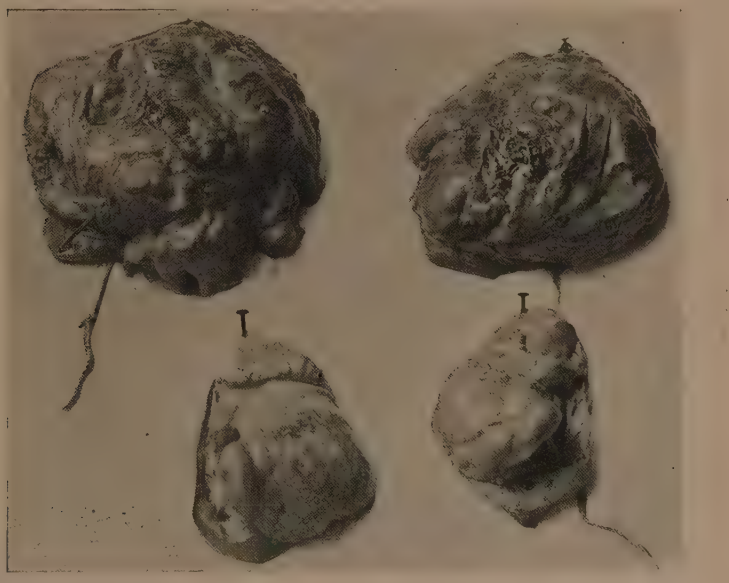

Fig. 35.—Sarcomatous tumors of the kidneys, removed from a child two years of age.

ilium and the lower ribs, and in this latter situation may simulate a sarcoma of the kidney. The differentiation is made by the more central position of retroperitoneal sarcoma and the normal condition of the urine. However, an exploratory incision is sometimes necessary to distinguish it.

Tumors of the Abdominal Wall.—These may be due to the formation of inflammatory exudates. They are easily distinguished on account of the strict localization. Sometimes (and particularly in young girls who are neurotic) there is spasm of the

rectí muscles, which may simulate tumors of the abdominal wall, but anesthesia soon dispels these.

ENLARGEMENT OF THE LIVER

At the time of birth the liver represents about one-eighteenth of the whole body-weight. The normal position at that period is so that the superior border of the right lobe extends in the midscapular line to the seventh rib; in the midaxillary line to the sixth rib, and in the midclavicular to the fifth rib. The inferior border extends in the median line not quite to the umbilicus. The lateral margin of the left lobe lies about one inch to the left of the median line. The upper margin of the left lobe is difficult to find on account of its being so close to the area of cardiac dullness.

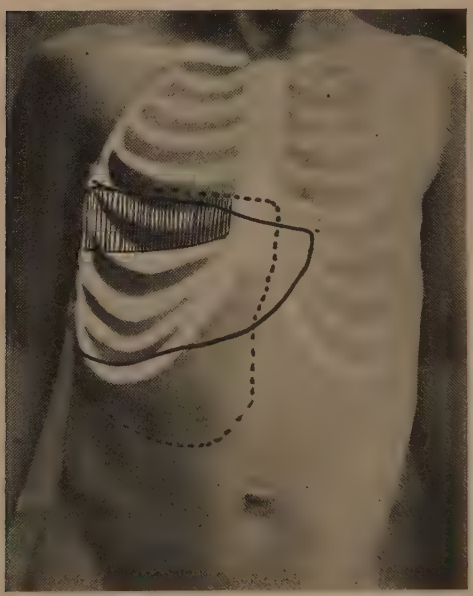

Fig. 36.—Outlines of the liver. The solid line indicates the outline of the normal liver as the child approaches puberty; the perpendicular lines indicating the portion of the liver covered by the lung. The dotted line shows the position and extent of liver dullness at birth. As the infant develops, the liver rapidly decreases in extent and the position is much changed.

The increase in the weight of the liver does not keep pace with the increase of the body-weight.

Quite soon after birth the area of liver dullness shows a decided diminution, and this is because of the elongation of the abdominal portion of the spine and the rapid growth of the infant's stomach.

Later on in childhood the descent of the diaphragm causes the liver to descend, so that at this period it is one or one and one-half inches lower (in its upper border) than in infancy.

The lower border progressively ascends until the time of puberty, at which period it generally corresponds with the lower border of the ribs.

Acute Enlargement of the Liver.—In early life it is difficult to definitely palpate the liver, for it is soft and yielding, but later on, when the organ has more solidity, the procedure becomes much simplified.

If the liver is acutely enlarged and the surface remains smooth and with a moderate degree of hardness, then such a condition suggests bile stasis. The most frequent cause of such stasis is catarrh, and next in frequency there are the congestions of the organ which are so often associated with infectious disease of any kind. In both instances, with the subsidence of the cause, the enlargement also disappears.

Fig. 37.—Palpating the liver.

In diagnosing acute enlargement there must be an exclusion made of those conditions which simulate it, as pleural effusions (in which the pulmonary affection and the general conditions which cause it must be all considered), subdiaphragmatic abscess, and spasm of the recti muscles.

Congestion of the Liver.—This can hardly be classed as a disease, and yet its importance is in its early recognition, as it is the condition which precedes every structural change in the liver. Hepatic congestion is either active or passive, and the most common causes of the active form are overfeeding, and particularly with fatty foods, the acute infections, cold, and shock. Of the passive form, the common causes are pulmonary obstruction,

and especially from pneumonia, atelectasis, pleurisy or emphysema, cardiac weakness, malaria, and chronic gastro-intestinal disorders.

There is always more or less hepatic enlargement, but it is easy to be deceived and to attribute this to the developmental period. Outside of the moderate increase in size of the organ, there are no symptoms which are constant, so that its recognition is often overlooked. In the active form there may be some tenderness over the organ. The passive form becomes chronic in nearly every instance, for the conditions causing it are usually of a chronic or persistent nature.

Suppurative Hepatitis.—This may be due to traumatism, pelvic peritonitis, umbilical phlebitis, tuberculosis, any acute infectious disease, or empyema. In infancy the symptoms are far from being characteristic, and there is the added difficulty of palpation which is not satisfactory. A loop of the intestine frequently gets in between the palpating fingers and the lower border of the liver, and this gives an apparent difference in the density of the liver, and abscess is at once suspected. Pain, which is ordinarily a valuable sign, is sometimes obtained when no abscess is present, for at times the pressure of the liver upward causes pain because of the existence of a pleurisy (which has not been suspected). The only reliable means of diagnosis is by exploratory aspiration, which may demonstrate the presence of pus.

Acute Infectious Liver.—During the course of the acute infectious diseases there occurs with considerable regularity an active congestion of the liver with interference with its function, and the subsidence of the causative disease usually means a disappearance of the symptoms of hepatic congestion and also of the moderate enlargement. But occasionally such is not the fortunate course, and instead of a disappearance of the symptoms, we encounter those of an acute infection, as chills, anorexia, remittent fever, vomiting, etc.

The liver becomes more enlarged, tenderness is more or less marked, and there are other symptoms of hepatic abscess. This condition may persist for weeks with more or less prominent symptoms of sepsis. The diagnosis is made from the history and confirmed by aspiration.

Chronic Enlargement of the Liver.—If the liver is chronically enlarged and with a smooth surface, it may be due to cardiac disease, chronic pleurisy, empyema, or to any disease or condition which interferes with the free return of blood to the heart.

Cirrhosis of the Liver.—There are two distinct stages to this disease, the first stage being one of enlargement of the organ, the second one of contraction. The disease is more common among children than is generally supposed, being due in many instances to chronic passive congestion from renal or cardiac disease, stenosis of the bile-ducts, syphilis, malaria, tuberculosis, the acute infections, and rachitis. The effect of chronic poisoning by tea, coffee, etc., is, I believe, problematic.

The local symptoms are first present, and then, by their interference with the general nutrition of the child, general symptoms are added. The local symptoms depend upon the amount of obstruction to the portal circulation. At first the symptoms are those of hepatic enlargement associated with gastritis. Later, the symptoms are more severe and are due to obstruction of the portal capillaries. These symptoms are ascites; the abdomen becomes distended and there is a sense of weight and fullness. The distention may be very marked. The spleen is enlarged to twice its normal size, although the ascites may interfere with the examination of the spleen. Constipation is the rule, although a violent diarrhea may occur at any time. Taken all together, the symptoms do not differ from those which are present in adult life; the only difference is that all of the symptoms are naturally influenced by the immaturity of the child.

The methods of diagnosis are the same as in the adult. The occurrence of jaundice is a most important symptom, for it is always present in children who are suffering with cirrhosis of the liver. It may not be prominent, but may be moderately developed, with definite periods of exacerbation. If the case is seen late when ascites is present, the history is of immense value, as is also the demonstration of a small liver associated with a large spleen.

Amyloid Disease.—The precise defect in metabolism which produces the deposit of amyloid substance in the middle coat of the arterioles, resulting in a waxy liver, lardaceous kidney, sago

spleen, etc., is not at all understood. It is fortunate, however, that some of the etiologic factors are understood, and these are the chronic tuberculous and syphilitic processes which affect the bones.

The presence of the disease as affecting the liver is evidenced by enlargement of the organ (the liver sometimes extending down to the umbilicus), while at the same time it is hard, with rounded edges, a smooth surface, and no tenderness upon pressure. There are also no symptoms of an arrested hepatic function. It does not occur independently, but there is the associated ulcerous bone affection. As the disease never affects the liver alone, there is also splenic enlargement, and, the kidney being involved also, we find albuminuria present.

Fig. 38.—Amyloid liver (outlined) in a child who was suffering from Pott's disease. Child is fastened upon a Bradford frame (Napier).

Fatty Liver.—This may be present in children who are overfed with fatty or sweet sugary foods, as well as in those who are the victims of wasting disease. The disease is evidenced by hepatic enlargement, with the surface of the organ entirely smooth, and the enlargement being moderate and the liver not very hard. There is no pain or tenderness, and icterus and ascites are absent. It is particularly liable to affect children who are the subjects of tuberculosis or rachitis.

Leukemic Liver.—This is similar to the liver seen in amyloid disease, but there is an absence of the etiologic factors of amyloid disease and the presence of unmistakable symptoms of leukemia (see Leukemia).

Echinococcus of the Liver.—This differs from all other forms of enlargement by its very slow and steady course (taking years to develop) and by the general good health of the affected child. There is an absence of ascites and also of icterus.

When a cyst is palpable, there is detected upon the free border of the liver a half spherical and smooth convexity. This gives fluctuation. The fluid which may be drawn from this cyst differs from all other exudates or transudates in being rich in sodium chlorid and showing an entire absence of albumin which is coagulable by boiling. If a microscopic examination is made, the hooklets of echinococcus may be revealed.

Sometimes it is possible to demonstrate the hydatid thrill, which is a sensation which is conveyed to the palpating finger as of a cushion with a spring in it. When percussion and auscultation are performed simultaneously, there is a distinct, deep, sonorous tone, and this is known as the hydatid resonance.

Syphilis of the Liver.—In a child of considerable age there may be a marked increase in the size of the organ, and on account of the formation of cicatrices and gummatous nodes, the organ may be lobular. The diagnosis is made by exclusion and by the history of previous syphilitic affection, and is confirmed by treatment.

Tumors of the Liver.—These are so rare that they are mentioned simply for completeness. Such growths are rarely, if ever, primary, so that the diagnosis is simplified by the history of tumors in other parts.

ENLARGEMENT OF THE SPLEEN

At the time of birth the spleen weighs about one-fourth of an ounce. It is very seldom that it can be made out by palpation, as it is situated so close to the posterior and descending wall of the diaphragm, opposite the ninth, tenth, and eleventh ribs, and covered anteriorly by the stomach. If it can be palpated at birth, then one of two conditions is present—it is enlarged or displaced. The long axis of the spleen is about parallel with the ribs.

Percussion of the spleen gives a dull sound which is strongly in contrast with pulmonary resonance above and the tympanitic (intestinal) note below. But percussion is not always satisfactory, for the results must be the same on successive days to be of value in diagnosis, and while this is being demonstrated, much time is

necessarily lost. Palpation is much more satisfactory, and this must be performed with the child on the back and with the legs flexed. All manipulations must be very gently but firmly performed, the pressure being at first light and then gradually increased as required. A moderate degree of enlargement may be said to exist when the lower border of the spleen can be palpated an inch below the free borders of the ribs.

Splenic tumor is recognized in the left hypochondriac region, by being freely movable laterally and at the lower border, while above it is attached. The inner border is palpated as a thin and rather sharp edge with a deep notch in its middle portion. An enlarged spleen generally retains it original shape, as the increase

Fig. 39.—Method of palpating the spleen.

is, as a rule, in all diameters. Enlargement of the spleen occurs as an acute or chronic condition.

Acute Splenic Enlargement.—This occurs in certain of the acute infectious diseases, as typhoid fever, malaria, diphtheria, epidemic cerebrospinal meningitis, blood-poisoning, and variola. The splenic enlargement is constant in two diseases, typhoid and malaria, and this may prove of considerable value in differential diagnosis, for it is not uncommon to find that in their early symptoms some of the gastric disturbances and meningitis markedly simulate typhoid fever, and the absence of splenic enlargement would at once arouse doubt as to the existence of the latter disease. While a diagnosis of typhoid fever cannot well be made without the demonstration of some splenic enlargement, it must

also be remembered that such an enlargement occurs in other fevers.

To be positive that an acute enlargement actually exists, we must be certain that such enlargement did not previously persist. It is not infrequent to have chronic enlargement present, and then, when some febrile condition occurs and the spleen is examined, the first note of its enlarged condition is made. One feature of acute enlargement is that there is usually slight pain present. There are some congenital conditions which are accompanied by acute splenic enlargements, and these are: Occlusion of the bile-ducts, umbilical phlebitis, hepatitis, infectious hemoglobinuria. Splenic abscess and acute splenitis from emboli are rare causes of acute enlargement.

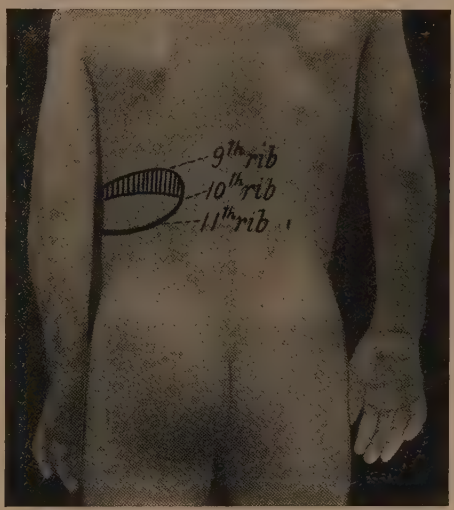

Fig. 40.—Outlines of spleen. Normal splenic dullness is observed between the ninth and eleventh ribs and at times slightly below the eleventh rib. The perpendicular lines indicate the portion of the spleen covered by the lung.

Chronic Enlargement.—In chronic enlargement the spleen is not only enlarged, but it is noticeably harder than usual. The degree of enlargement is generally such that the spleen extends for over two inches below the border of the ribs. In most cases there is an absence of any acute febrile condition.

One must not be misled by mistaking chronic enlargement for acute enlargement when some acute febrile condition is existent. In infancy chronic enlargement is most common in rachitis and hereditary syphilis. In rachitis it is most frequent during the first year of life and is usually present only in the severest types of the disease, and this fact makes the chances of mistaking the

cause of the enlargement almost *nil*, for the other symptoms of rachitis are so fully developed.

Occurring in the course of hereditary syphilis, the other symptoms may remain obscure for a considerable length of time, and the splenic enlargement and the indefinite general symptoms might readily lead one to suspect leukemia or amyloid spleen, and this is particularly true if the anemia which is sometimes very marked in syphilis is a pronounced feature.

If the white blood-corpuscles are not increased, then leukemia is excluded as a cause, and when the differentiation is to be made between amyloid disease and hereditary syphilis, the histories are most valuable, and are really the determining factor. In amyloid disease there is suppuration going on somewhere in the body, and the liver is enlarged as well as the spleen.

After the period of infancy is past, chronic splenic enlargement is in nearly every instance due to chronic malarial poisoning. In regard to the recognition of chronic malarial poisoning, the history of a malarial cachexia and the blood-condition are usually sufficient to distinguish it.

In simple anemia with a moderate leukocytosis, during the period of infancy, splenic enlargement may be pronounced, but the association is generally with some gastro-intestinal disease, syphilis, or rachitis, and there is sufficient reason to believe that while the cause remains obscure, it does so only because of our inability to recognize it with present methods. Probably the splenic enlargement is always secondary to some infection which has not been recognized. In leukemia and in Hodgkin's disease there is splenic enlargement of a chronic type, but there is considerable enlargement of the liver also.

New-growths of the spleen causing its chronic enlargement are rare, but they do occasionally occur, and when they do, they are generally varieties of sarcoma. They are rarely, if ever, primary, and are recognized by the occurrence of malignant disease elsewhere in the body, and by the associated symptoms of malignant growths.

DIARRHEA

Diarrhea is a sign of some disorder of the intestine and may exist as an acute or a chronic disorder. While it is a symptom, it is of itself the cause of other symptoms. Diarrhea may be said to exist when there is an increased frequency of the acts of defecation or when there is an abnormal fluidity of the stool. Increased frequency is generally due to increased peristalsis, but not all increased peristalsis results in diarrhea.

In nurslings the bowels should be moved twice or three times during the twenty-four hours, and the stool should be of jelly-like consistency and without an excessive amount of fluid present (a normal amount of fluid would be such as would wet the diaper to a similar extent as would about a half-teaspoonful of water). The color should be yellow or orange, and the odor never ought to be more than faint. There is normally a varying quantity of mucus, which is closely admixed with the stool and never separated from it or gathered into distinct lumps. Mucus which is visible to the unaided eye is always indicative of an excessive production.

In the older child, after the period of weaning there is a much closer approximation to the adult both in regard to the frequency of the movements (which should be one or two in the twenty-four hours) and the consistency of the stool (which should be well formed). The color is gradually changed as the child ages, so that from the yellow stool of the nursling it becomes a dark brown as milk as an article of diet is substituted by other things. The odor also changes, becoming somewhat stronger, but never offensive.

The etiologic factors of diarrhea are chiefly four in childhood and infancy: Age—one year and under, during which time the infant is very susceptible. Season—summer, and especially during a protracted heated term. Poor hygienic surroundings. Improper feeding, whether of quantity, quality, or composition.

Of the cases which have a fatal issue, the four chief associated factors are tuberculosis, rachitis, marasmus, and hereditary syphilis.

In a determination of the number of movements which have occurred it is advisable to get into the habit of asking at what time the movements occurred. Two things are conserved by this: First, it impresses the mother with the fact that the condition of the bowels is not a matter to be slighted, and it prevents the possibility of exaggeration, which is common enough. Many times I have tested intelligent mothers and received the statement that the baby's bowels moved surely a dozen times, and then when definite information was sought in regard to actual time, observed that the dozen shrank rapidly to three or four. Secondly, and of more importance still, it furnished a clue to diagnosis in those occasional instances where malaria exhibits most of its periodicity upon the condition of the bowel. Several evacuations occurring within a short time and periodically may be the first hint of the real cause. Another thing that must be considered is the fact of possible drug ingestion by the child or the nurse, for these frequently are the cause of increased movements.

In deciding about the color of the movement, inspection must follow almost immediately after an evacuation. Most stools turn green very shortly after their passage and also become drier upon exposure to air. Following the administration of calomel or of bicarbonate of soda, the color of the stool may be quite green even at the time of its passage.

The symptoms which are associated with diarrhea depend largely upon the cause and somewhat upon the frequency of the movements. They are chiefly pain, tenesmus, and flatulence.

The pain is especially dependent upon the cause. If the irritating material is some product of digestion, pain is referred to all portions of the abdomen and is usually quite severe, being particularly marked immediately before a movement. If due to inflammation, the pain is more constant and localized.

Tenesmus depends most upon frequency, so that it is almost uniformly observed in diarrheas from any cause in which the

evacuations are very frequent. It is noticeable with greatest severity immediately after the bowel has been evacuated.

Flatulence is common in most of the diarrheas of infancy and itself is the cause of much distress. Usually it is general over the abdomen, but in enterocolitis is more localized over the course of the colon.

General symptoms are elevation of temperature and more or less weakness, according to the cause and the severity of the diarrhea. Prostration is an accompaniment of all forms, while collapse is observed most frequently in cholera infantum.

CAUSES OF ACUTE DIARRHEAS

There are in children disorders which are called functional, and these, when they affect the condition of the intestines, are apt to do so not alone, but with an associated involvement of the whole gastro-intestinal tract. We do not fully understand the nature of a so-called functional disturbance, and so many times the beginning of disease is masked under this flexible term, until such time as its development is so marked that a definite clinical entity can be recognized.

The necessity for the use of the term in the gastro-intestinal disorders of childhood is unfortunate, for the slightest disturbance in this class of cases should receive prompt attention. This is especially true of diarrheal conditions, which, until their nature is thoroughly understood, should be treated as the possible beginning of a fatal disease; this applies with most force during the first year of life.

When the food enters the stomach, it carries with it innumerable bacteria. Some of these are at once destroyed, others are reduced in virulence, and still others pass on unchanged into the intestine. If the number of the latter be large, they are capable of producing organic acids in the small intestine by a decomposition of the carbohydrates or a splitting of the fats. The food is passed with considerable rapidity (a few hours at most) through the duodenum and the ileum, so that here there is little time for bacterial multiplication. In the large intestine the passage is slower and the amount of material which is absorbed leaves little to decompose.

But the greatest protective factor seems to be the inhibitory control which the normal intestinal bacteria exert upon other bacteria. Let this action become disturbed, as it seems to be in the so-called functional disorders, and one can easily see that the infant becomes an easy victim to intestinal disease.

The development of the normal intestinal flora occurs as early as the fourth day of life. Most of the intestinal disorders can be reasonably traced to an abnormal bacterial action in the intestine.

The normal bacteria of the bowel may either increase in number or in virulence, or other bacteria may give rise to pathologic conditions. Bearing this in mind, we must recognize at once that, during infancy at least, there are many factors which may influence the onset of diarrhea.

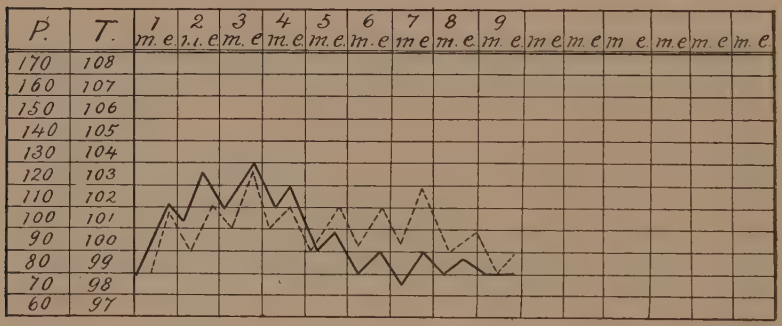

Fig. 41.—Chart of the temperature (—) and pulse (----) in intestinal autointoxication; child aged three years. No medication until the afternoon of the fourth day.

Nervous Diarrhea.—This may have its cause outside of the intestine. A shock, such as the sudden chilling of the body, may be sufficient to produce it. In others it is brought about only by some definite condition which produces nervousness. Usually in diarrheas of this type it is not difficult to discover neurasthenic or hysterical stigmata. The watery character of the stool is probably due to a hypersecretion from the intestinal mucosa, under the influence of nervousness. This diarrhea is characterized by several watery movements (five or less) occurring suddenly under the influence of some excitement or fatigue, and as suddenly stopping within a few hours when the nervous condition has had time to subside.

Eliminative Diarrhea.—Between the diarrheas due to nervous influences and those which are due to intestinal disease there is a type which is best termed eliminative diarrhea, as its exact mode of production is not fully understood. It accompanies many of the general diseases and is most typically observed in uremia and in some of the acute infectious diseases, particularly rubeola. That toxins produced by the general disease cause the condition is the most reasonable deduction. The diagnosis must take into consideration the associated general disease (particularly its severity), and there must be an exclusion of all other possible causes.

Fat Diarrhea.—This is a form of dyspepsia. There is an increase in the amount of fat in the stools of all children who are the subjects of dyspepsia, irrespective of the underlying cause, but in this disease the increase is very marked. In all other particulars the stool is similar to that of the dyspeptic. Microscopic examination of the stool reveals the presence of large amounts of fat; the whole field is crowded with large fat-globules.

Acute Intestinal Indigestion.—Diarrhea is a constant feature of this disease. According to the development, there are associated with the disease gastric symptoms: with a sudden onset they are present; with gradual development they are absent. I shall first consider the disease as it affects infants, and later will make reference to the dissimilar symptoms in the older child.

The local symptoms are pain, tympanites, and finally diarrhea.

Pain is evidenced by the sharp, piercing cry, marked restlessness, and drawing up or throwing about of the legs; or, in other words, there is a sharp attack of colic. There is an elevation of the temperature to 102° to 105° F., but within twelve to twenty-four hours this has returned nearly to the normal point. Associated with the fever there is much prostration, which may be severe enough to threaten the life of the infant. The pulse is rapid and the prostration is shown by the drawn features and general muscular weakness.

Tympanites may not be marked at the onset, the rule being a gradual development of this symptom.

Within a few hours of the onset the diarrhea sets in, and the stools are increased to from four to twelve in the twenty-four

hours. The first stools are fecal, but rapidly become less so, assuming a yellow, then a greenish-yellow, and finally a grass-green color. The consistency is soon lost, so that within a few hours the stools are fluid. The odor becomes sour or may be foul. Unless the disease has continued for several days there is no mucus present in the stool. Undigested food is always present, however, and this is seen as lumps of casein or of fat.

The course of the disease depends upon several factors, chief of which are the previous condition, the nature of the exciting cause, and the time at which treatment was instituted as well as its nature. With an infant in previous good condition, prompt removal of the cause and proper treatment early applied, the disease lasts about forty-eight hours. Otherwise the disease may become the factor which allows the development of a pathologic process of the intestinal with serious organic changes.

In older children, several hours before the occurrence of diarrhea, pain is complained of about the navel. The temperature is not elevated markedly, but usually rises to between 101° and 102° F. Like the temperature, the prostration is by no means marked, nor are the consequences of the disease such as is frequently observed after an attack or a succession of attacks in infants.

The diagnosis may sometimes be made from the early symptoms, when there is a clear history of a sufficient cause and of previous attacks. But it must not be forgotten that many of the acute infectious diseases begin with very similar symptoms, so that much caution must be exercised until the occurrence of the diarrhea. From other diarrheal diseases it is distinguished by the shorter course, the less marked nervous symptoms, and the character of the stool.

Acute Gastro-enteric Infection.—There are two quite distinct developments of this disease—the mild, with a gradual onset, and the severe, with a rapid occurrence. These will be described separately.

The mild form with a gradual onset has symptoms which in the beginning are so slight that the case is usually considered one of "teething" by the parents. There is at first little or no fever and but slight, if any, gastric disturbance. In fact, it is not unusual to find that during the first three or four days the diarrhea

is the only symptom, possibly accompanied with some peevishness. There is one characteristic of the movements—they increase in frequency. The stools are thin, and may be green, brown, or yellow.

The tongue is coated, the appetite is but little changed, but in infants who are not in good condition generally, thrush may develop. The general condition of the infant is one of flabbiness and evident weakness. Toward the end of the first week the odor of the stool becomes offensive and mucus is present as well as undigested food.

The infant is now in a condition during which the slightest error in diet or lack of care will result in a relapse which is more often of the severe type to be shortly described. However, with proper care, diet, and treatment, there is a gradual improvement so that the child is well again in about two weeks.

In the cases with a sudden onset there may be no warning, or for some days previously there may have been evidences of slight intestinal derangement. The infant is restless and is in evident discomfort, crying much of the time. The temperature is rapidly raised to 102° to 106° F., and all indications point to a sudden and severe illness. The prostration is sometimes marked; the infant lies in a dull stupor with sunken eyes and a general relaxation, or may be delirious. Thirst is excessive, but whenever fluid is given, it is almost immediately vomited. The vomiting is an occurrence which comes on about four or five hours after the first symptoms of the onset, and is first of the stomach contents, which have become sour; then, when continued, it consists of mucus, bile, and serum.

Except those cases in which slight intestinal disturbance is present for a few days before the onset, diarrhea does not show itself until several hours after the sudden onset. The first stools are fecal, but it is not long before they are simply bursts of flatus which bring with them a thin yellowish or greenish-yellow material which has an offensive odor. It is not usual for the color to be brown, yet this is sometimes the case. The color is somewhat typical, but the really characteristic features are the amount of flatus and the odor. The movements may occur hourly, and preceding them there is more or less crampy pain.

After the first day, although there may be little improvement in the condition of the bowels, there is generally an improvement in the general condition of the infant. Under the most advantageous conditions two or three days may witness the establishment of convalescence, but conditions are not usually so excellent, and there is a development of ileocolitis (see page 161). In other cases, instead of the expected improvement, there is a steady decline, with a rapid termination in death.

In older children the clinical picture is much the same as in infants, but there are less vomiting, prostration, and temperature, with more pain and more rapid improvement.

The diagnosis is made mainly from the character of the stools, which is substantiated by the mode of onset and the associated symptoms. Until the stools become somewhat typical, the onset may suggest any of the acute infectious diseases, pneumonia, and influenza. For the exclusion of the first, one must wait until the time for the appearance of the eruption; in regard to the second, the increased respirations and physical signs aid in the detection of pneumonia, and from influenza one has to recall the peculiarities of the disease in different epidemics, and these usually make the distinction clear.

Acute indigestion cannot always be excluded or recognized, but, as a rule, such attacks are not accompanied by so great a disturbance of the nervous system, by such offensive and frequent stools, nor by the flatus which is so evident in acute gastro-enteric infection.

Naturally, the influence of heated terms in the production of the disease will offer some help in the differentiation. When the condition of the bowels improves and the other associated symptoms do not do so proportionately, it should at once arouse a suspicion of some other disease.

Cholera Infantum.—This is fortunately a rare disease, with an intimate clinical association with gastro-enteric infection, so that severe cases of the latter are not always distinguishable from cases of cholera infantum.

Usually the onset is abrupt, with persistent vomiting and high temperature, and this following some preceding intestinal disorder. Primary cases are comparatively rare. High and gradually

rising temperature with marked early prostration usually marks the onset of the disease, and within a very few hours there are the added symptoms of vomiting and diarrhea. Vomiting usually precedes diarrhea by three or four hours or both may develop together. The first vomiting is of the stomach content, then serum, mucus, and bile. Usually within twelve hours the diarrhea is well established, twenty to forty or more movements occurring in one day, and being so large and so fluid that they drain the body of its fluids. After the first few stools the movements seem to consist of serum, which is readily absorbed by the diaper and has a putrefactive odor.

The draining of fluids from the body and the high temperature soon cause the child to become pallid, pinched, and flabby, the sunken eyes exhibiting a rapidly gathering film, the fontanelle depressed, cold, corpse-like extremities, and general marked prostration, while the temperature may be 105° to 107° F. The abdomen is flattened or sunken (usually the latter). The cry is reduced sometimes so that it is simply a moan or whine. Within twenty-four hours of the onset the infant may be close to death, which may be delayed for another day or two, for cases rarely recover. Occasionally instances are observed where death ensues within five or six hours. The loss of weight is more noticeable in cholera infantum in a corresponding period than in any other condition. Thirst is never satisfied; the child constantly desires liquids.

The clinical picture is so typical that there is no chance for any error in diagnosis.

Acute Ileocolitis.—Inflammations of the colon, ileum, and large intestine have unsatisfactory classifications, which is largely due to our ignorance of the true conditions present. But without entering into this fully, it is enough for our purposes to make the statement here that colitis and ileocolitis are not sufficiently marked to claim separate consideration, except as they do in this section, in which the distinction is lost under the heading ileocolitis. This disease usually follows some infective enteritis, especially acute gastro-enteric infection.

The general course of the disease exhibits this peculiarity—that the severity of the symptoms is not fully explained by the

lesions, so that the influence of toxins must occupy a large place. Usually the development is secondary, but it may be primary, and in either event there is evidence of stomach disturbance associated with diarrhea and a rise in temperature.

The onset is usually sudden, with the vomiting persisting for twenty-four hours (sometimes less), and the pain, frequency of the stools, and their character indicating little more than that the attack is probably due to an error in diet. Soon, however, the characteristic stools are present, and these are composed mostly of blood and mucus, their discharge being preceded by pain and accompanied and followed by tenesmus. The stools are frequent (usually every twenty to thirty minutes) and are also small (less than one-half ounce), but always discharged with much straining. The blood is usually streaked through the movement, and is rarely in any considerable quantity.

The tongue is heavily coated, loss of strength and weight is quite apparent, and the child is visibly prostrated. At first the abdomen shows no marked changes, but later it generally becomes enlarged, tympanitic, and tender. The temperature for the first day is from 102° to 104° F., then ranges about 100° to 101° F. for the rest of the time. Generally thirst is marked.

Severe symptoms such as these persist for a week, after which there is a slow convalescence, the onset of which is first marked by the disappearance of blood from the stools. Following this there is a gradual subsidence of all the symptoms of the disease.

In those cases which exhibit follicular ulceration there are some symptoms which are suggestive that the disease is of that type. In the first place, vomiting is not a marked feature, being only present for a very short time at the onset. The stools are less in number (from five to ten daily) and larger in amount, containing little, if any, blood, but large amounts of mucus (an ounce or more). The course is much more protracted, although all the initial symptoms are much improved after the first few hours.

The membranous type is unusually severe and ordinarily fatal to life. Its chief development is between the ages of six months and two years. In this type the general symptoms are apt to be so extremely severe that they mask the intestinal ones to an extent. It can only be positively diagnosed during life if there

are shreds of membrane discharged with the stool, and this is not the usual occurrence. Only small patches of membrane are discharged, and these are readily distinguished from mucus by washing.

Ileocolitis must be differentiated from acute gastro-enteric infection, and this is aided by the consideration of the marked frequency of stools containing some blood and much mucus (or possibly membrane), by the character of the temperature and the vomiting.

From intussusception the diagnosis is not difficult, for although there is a sudden onset with vomiting, pain, and marked prostration, rise of temperature is absent in intussusception. The later symptoms of intussusception (obstinate constipation, tympanites, tumor, collapse, etc.) do not in any way simulate ileocolitis.

The possibility of a mistake in regard to typhoid need only be thought of, the distinctive features being so marked.

CHRONIC DIARRHEAS

In the presence of any condition of chronic diarrhea the possibility of several diseases would at once be thought of: these are tuberculosis of the intestines and mesenteric glands, chronic ileocolitis, chronic intestinal indigestion, and malaria. I think that it will be well to describe these sufficiently in detail for their recognition, and then consider the differential diagnosis collectively.

Tuberculosis of the Intest nes and Mesenteric Glands.—The almost invariable constancy with which these two conditions are associated makes it advisable to consider them together.

The symptoms are anything but constant, and of all the inconstant symptoms, diarrhea is the most constant, usually being exceedingly obstinate. The stools have nothing about them that is at all characteristic (they resemble those of chronic ileocolitis) except the presence of the tubercle bacilli. Hemorrhages may occur, but they are not very frequent occurrences. There may or may not be localized tenderness in the abdomen, which is usually soft.

Of course, when the case is a prolonged one, the symptoms of the intestinal ulceration are associated with those of peritonitis, and enlarged mesenteric glands may then be felt, if they are of considerable size.

Chronic Ileocolitis.—After the symptoms of the acute attack have passed over, pain, tenderness, and temperature all may become so slight that they are scarcely noticeable. But the weight remains at a standstill and the general condition of the child continues to be bad.

The little one is an easy prey to all infective processes, and stomatitis is common. In fact, all the chief symptoms arise from the fact of the existence of great physical depression, fermentation in the intestine, and alteration in the glandular structure of that canal. Now, understanding that these three main conditions are present, it is needless to enumerate all the symptoms which would result, for these vary with each child.

There is a marked peculiarity of many of these cases, that they will not indicate a desire for food, but when it is offered to them they take it in almost unlimited quantities. And no matter how good the appetite, the child does not gain in weight and strength.

The stools will average about five daily, being a little thinner than normal, and containing mucus in considerable amounts. The color of the stool may be gray, brown, or green, usually the latter. Undigested food is always present. The odor becomes offensive. The abdomen may be enlarged and puffed out.

The child is peevish, restless, and cries almost continually day and night. Other than this, the symptoms depend upon the three conditions previously mentioned. Many of the children die during the first four months, but the disease may continue for a year, and the whole course is marked by periods of apparent improvement followed shortly by exacerbations.

Chronic Intestinal Indigestion.—The general symptoms are those of malnutrition or marasmus, the chief of which are loss of weight (actual or relative), marked anemia, subnormal temperature at frequent intervals, constant fretfulness, anorexia, sleeplessness, and muscular weakness.

The tongue is coated, as a rule, and in some instances the appetite may be good, but this is usually followed by vomiting,

so that the child with anorexia holds his own with the child who eats well and vomits often. Vomiting can in nearly every instance be laid to the ignorant desire to crowd the nourishment beyond the child's capacity.

Diarrhea is usually not constant, but there is an alternation with periods of constipation. The diarrheal stools are thin, containing food and some mucus, have a sour, unpleasant odor, and are green. In the periods of constipation the stools are white or gray and may be pasty or hard. They are generally coated with mucus and may be blood streaked. Usually associated with the constipation there are frequent sharp attacks of colic. Low irregular fever is not infrequent, and when it occurs, usually persists for days or even weeks at a time.

Malaria.—Sometimes malaria will evidence itself in a child chiefly by an apparently causeless diarrhea. If one will always foster the habit of asking, "At what times did the bowels move?" instead of the usual one of "How often did the bowels move?" many of the cases which go unrecognized for a long time would be diagnosed at once.

As was suggested before, the differential diagnosis will be considered collectively.

The Stool.—In Tuberculosis: Almost exclusively fecal, although at times there may be small quantities of undigested food, and especially those of a fatty nature. The consistency is somewhat thinner than normal and there is some mucus present. Tubercle bacilli present; only positive evidence.

Chronic Ileocolitis: Almost identical with the above, but with the presence of undigested food more constant and not so limited to those of a fatty nature.

Chronic Intestinal Indigestion: Thin stools with undigested food and some mucus and an odor which is not offensive, but sour.

Malaria: Thin, offensive, and fecal, usually followed by normal stool later in the day.

The Diarrhea.—Tuberculosis: Occurs for a few days at a time and then stops, only to recur again. Diarrhea is only constant toward the last. There may be colicky pain preceding the movement, but it is never marked.

Chronic Ileocolitis: The diarrhea does not exhibit any tendency

to improve. Apparent improvement may occur after an exacerbation which is traceable to some error in diet or care. Colic is the rule.

Chronic Intestinal Indigestion: Alternating attacks of diarrhea with constipation.

Malaria: A few loose movements within a short period, then, if there is another movement, it is nearly normal. Diarrhea occurs about the same time every day, or every other day, but in any event is periodical.

The Condition of the Abdomen.—Tuberculosis: Soft and sensitive upon pressure until the occurrence of considerable peritonitis.

Chronic Ileocolitis: Abdomen usually enlarged and more or less puffed out, in strong contrast to the wasted body.

Chronic Intestinal Indigestion: No marked change except as part of a general wasting.

Malaria: Abdomen normal except for an enlarged spleen.

General Considerations.—Tuberculosis: Usually occurs after the third year and is associated with evidences of tuberculosis in remote parts. History of infection.

Chronic Ileocolitis: Most frequent early in life and follows an acute attack. There is no tendency to rise of temperature.

Chronic Intestinal Indigestion: If any fever it is low, and irregular.

Malaria: Occurs at any age, even in nurslings. Periodicity marked. Therapeutic test is available.

INCONTINENCE OF FECES

Incontinence of feces must not be mistaken for diarrhea; this is barely a possibility, and yet I have seen this error made simply from a careless disregard of the condition of the child. It is common in transverse myelitis and in all paraplegic conditions due to an injury of the spine in the lumbar region.

During the course of some of the acute and chronic diseases which cause a marked amount of prostration it may occur as a transient symptom, and this is especially true of typhoid fever, tuberculosis, cholera infantum, and some cases of acute gastro-enteric infection and pneumonia. It is a common accompaniment of all adynamic nervous conditions from any cause.

The same conditions which result in incontinence may later bring about a condition of obstinate constipation, for the relaxed and inactive sphincter may not simply allow the escape of the contents of the bowel, but may, by its inactivity, associated with that of the rectum, allow the feces to mass themselves in and above the rectum. With lessened secretion of juices this mass soon becomes caked and results in a troublesome condition of constipation. Incontinence of feces associated with incontinence of urine is one of the symptoms of an epileptic convulsion, and helps to distinguish it from other similar seizures.

PAINFUL DEFECATION

Painful defecation is generally associated with rectal tenesmus, but this is not invariably the case. The two conditions must not be confused (see "Rectal Tenesmus," page 168).

The commonest cause of painful defecation in children is fissure of the anus. It is of very frequent occurrence and may be due to several causes (injuries from syringes, the passage of hard, dry feces, etc.), but is always the source of much discomfort to the child. The fear of pain which accompanies a movement from the bowel results in a state of chronic constipation which tends to keep up the primary condition.

The pain at the time of defecation is very severe, and it may persist for a considerable time after the act of defecation. General symptoms of a reflex nervous disturbance may be added, and may be so severe as to interfere materially with the general good condition and nutrition of the little one.

Hemorrhoids may be the cause of painful defecation, but hemorrhoids are rare in young children. Occasionally they are associated with anal fissure, and are probably dependent for their existence upon the condition of chronic constipation. When hemorrhoids are present, they are usually very small and externally located, so that inspection is usually sufficient to detect them.

When proctitis is present, defecation is usually painful, but this is generally predominated by the tenesmus which is present.

RECTAL TENESMUS

Rectal tenesmus is evidenced by a constant desire to empty the rectum. This is associated with more or less pain, as a rule, and the effort to defecate is partly or wholly ineffective. It is a rather common associated symptom of the various diarrheas in young children, being most noticeable and intense in cholera infantum. If a diarrhea has been caused by irritant poisons, tenesmus is apt to be a very prominent feature. If it is associated with the discharge of mucus or bloody mucus without the admixture of feces, it is at once suggestive of intussusception. It is an important diagnostic symptom of other conditions, as follows:

Proctitis.—This inflammation of the rectum is not infrequent, and is a prolific cause of rectal tenesmus. The prominent symptoms of tenesmus, pain, and discharges of mucus from the rectum are usually sufficiently marked at the very beginning to allow of an early diagnosis. When the condition is a primary one (which is not the rule), the disease is early recognized, but when secondary (as it generally is to inflammation of the large intestine), the symptoms are so masked with the original disease that no distinction is made unless the symptoms of the rectal inflammation predominate. The causes are generally local ones, and the most frequent is the prolonged use of suppositories or enemata.

Defecation is usually painful, while tenesmus is present invariably during the act and usually for a long time after. The mucus which is discharged from the rectum is jelly-like and clear, but at times may be mixed with feces or be passed in a cast, Frequently slight hemorrhage is evident. The discharge is generally so irritating that the skin is reddened and inflamed by it.

If instead simply of clear mucus the discharges contain pieces of pseudomembrane, then the condition is known as membranous proctitis. This condition is usually an acute one, but its persistence is not infrequent.

Sometimes the disease is accompanied with ulceration (ulcerative proctitis), which is superficial. The ulcers are always small and several in number, but the mistake must not be made of supposing the coalescence of several small ulcers to be a large ulcer. In these cases the hemorrhage varies considerably, one time being

very small, the next time being considerable in quantity. When the ulcerations are situated high in the rectum, the tenesmus is less marked, but there is always an increased reflex excitability of the rectum in all forms of proctitis, which results in rapid ejection of the discharges from the rectum, and this should always arouse a suspicion of inflammation.

Examination will show, in the milder forms of the disease, a state of mild prolapse and considerable reddening and congestion of the rectal mucosa. There will also be noticed an abundant secretion of mucus. To distinguish the ulcerative form it may be necessary to make a digital examination.

Rectal Polypi.—As a rule, the first indication of the existence of a rectal polypus is the occurrence of continued tenesmus and the discharge of bright red blood with, but not mixed through, the stool. There is no way to make the diagnosis except by rectal examination. Digital exploration easily detects the growth, which is usually single and is pediculated.

CHRONIC CONSTIPATION

This condition may be said to exist when there is a lessened frequency in the movements, when the act of evacuation of the bowel is more difficult than normal, when the stool is drier than normal, and when the total amount of the feces is much reduced. It is not unusual for more than one of these factors to be present at the same time. The foregoing points must be considered, for to the lay mind constipation exists only when the bowels do not move as often as usual.

The average infant at the breast moves the bowels about two or three times daily, but there are occasional instances in which an infant will have but one evacuation daily, and if observed over a protracted period, there are no untoward effects; in such a case constipation cannot be said to exist. On the other hand, the bowel may be evacuated with normal frequency and yet the amount be so small that constipation actually exists, and shows its effect upon the general condition in time. The same thing applies if the movements are normal in number and amount, but deficient in fluid, causing hard, dry feces.

The estimation of the time required for the passage of the food through the gastro-intestinal tract may at times be very important. A pure milk diet occupies from thirty to forty hours in passage from mouth to rectum. The simplest means of testing the time occupied is to give one meal stained with either charcoal or, better yet, with carmin, and then watch for the first black or red stool.

Occasionally we observe an infant suffering with a latent constipation with some toxic symptoms, and still having one or more evacuations every day, and the cause is not suspected until an estimation is made of the time of the passage of food through the digestive tract. Further than this, such an estimation is useful in diagnosis of other conditions, as shall be shown later.

The Causes of Chronic Constipation.—These may be divided into causes within and causes outside the bowel.

Of the first division, we have the position and development of the infant's intestines and rectum favoring bowel inactivity. Early in infancy the rectum is placed more in the abdominal cavity than in the pelvic, and occupies a more or less vertical position. The ascending colon is very short and the large and the small intestines are both proportionately longer than in the adult. The proportionately greater length tends to lessened peristaltic movement; lessened movement tends to slow passage, therefore to dryness of the fecal mass. The proportionately larger surface also favors absorption and consequently produces dryness.

The glands of Brunner and Lieberkühn are not fully developed in early life, and as they are active factors in bowel activity, this underdevelopment favors constipation from dryness. The amount of intestinal juice may be sufficient, but it may be too viscid. There may be a mechanical obstruction in the intestine, or some condition which diminishes the lumen of the gut.

Of the causes which are not within the intestine, we have constipation as an accompaniment of many of the acute and chronic diseases. Fever naturally diminishes the amount of fluid in the body, and in the diseases accompanied with elevation of temperature, unless diarrhea is the usual concomitant, constipation is the rule.

Any disease, either acute or chronic, which considerably lowers the muscular tone also diminishes peristaltic movement. Sometimes the peristaltic movement is so incomplete that the mass is passed through the intestine very slowly and becomes dried. Fear of pain which is caused by the act of defecation (as in anal fissure) will result in chronic constipation.

The chief of all causes is the diet. In nurslings this is usually due to a lack of fresh water; in bottle-fed babies, to a deficiency in fat and an excess of proteids. Then, again, it may be due to a lack in the volume of the residue of food in the intestine. Too much casein or starch and too little sugar may be the cause, or it may be due to the constant use of sterilized milk. Habit plays a much more important rôle than is commonly supposed,

and in the production of a chronic constipation it holds second place to diet. Occasionally it is a constitutional tendency.

The symptoms are at times purely local for a while, but this is unusual. Generally the nutrition and general health are more or less affected. There may be simple flatulence, accompanied or unaccompanied by colicky pains, or the irritating mass in the intestine and rectum may excite some inflammation. When inflammation occurs, it is evidenced by tenderness and by the presence of mucus and perhaps blood in the stool.

The absorption of toxins causes, in susceptible infants and children, nervous symptoms of a varied and sometimes a severe type. Usually these symptoms are cephalalgia, disturbed sleep, peevishness, dullness, and associated signs of intestinal disorder. A slight rise in temperature sometimes accompanies these symptoms, and this is especially true of delicate infants.

The diagnosis of the condition alone is not sufficient; there must be a determination of the cause, and, if possible, of the site of the trouble. The diagnosis of the first must take into consideration everything which affects the normal state of the bowel, and this involves primarily a thorough examination into the diet and habits.

With regard to the site of the trouble, a test-meal is valuable. We know that normally the food of a nursling requires from thirty to forty hours to pass from the mouth to the rectum. Now, if one meal is colored with carmin or charcoal and the time of the passage of the first red or black stool is noted, we can readily estimate the time occupied in passage through the whole tract. If the time is close to normal, it indicates that the lower or middle portion of the large intestine is at fault, and that peristalsis is not much increased in the small intestine.

White or gray stools, offensive breath, and flatulence all indicate affection of the small intestine. When the insertion of a suppository is immediately followed by a movement, it is indicative that the rectum is at fault.

INTESTINAL PARASITES

Until very recently many of the ills of childhood were attributed to the presence of intestinal parasites. The laity are still firmly convinced in regard to this matter, and all sorts of trouble is laid at the door of the "worms." The pendulum has now swung as far the other way, and it is not infrequent to find writers denying that any appreciable symptoms are due to the presence of intestinal parasites. Their claim is based largely upon the fact that at autopsy it is not uncommon to find these parasites present in large numbers, while during life nothing occurred to give evidence of their presence. But, on the other hand, there are innumerable instances where the expulsion of intestinal worms during life has been immediately followed by the disappearance of symptoms which could be accounted for in no other way than by their persistent presence.

The marked tendency of the laity to dwell upon the importance of worms (and also dentition) as causative factors of all kinds of conditions has often led the physician to take the other extreme, denying that any symptoms are caused by them. To deny that the parasites have any influence in the production of certain symptoms is to deny the experience of many careful observers; it places a ban upon the findings of experienced hematologists and shows an ignorance of the highly sensitive organism of the child, which renders it so susceptible to reflex influences.

Of course, when it comes to a question of positive diagnosis, the parasite or its egg must be seen, but in nearly every instance they are observed because there has been some symptom which has led to a suspicion of their presence and some measures have therefore been instituted for their removal.

Oxyuris Vermicularis (Pin-worms).—This is by far the most common variety of parasite which inhabits the intestine of children. In appearance it is like a thread, white in color, and from one-half to one or more centimeters in length. The female is about twice the length of the male. Pin-worms usually inhabit

the large bowel, migrating, as a rule, during the early evening toward the rectum and making the anus their feeding-ground.

The symptoms which are present are usually due to this habit of the parasite. Shortly after the child has been put to bed there is more or less intense itching about the anus, and sometimes about the genitals (the latter especially in girls). This irritation causes other symptoms which vary with the susceptibility of the child's nervous system to reflexes. The usual symptoms are restlessness, wakefulness, with scratching at the anus, incontinence of urine, and at times vomiting. In such cases an inspection of the anus will almost invariably disclose the presence of some of the worms. If not, then an enema of warm water and quassia will bring them into view in large numbers.

Fig. 42.—Oxyuris vermicularis (natural size).

Ascaris Lumbricoides (Roundworms).—This variety of parasite very closely resembles the common earth-worm. It is from three to twelve inches in length and of pale pinkish-white color. The shape is round, with gradual tapering toward both ends. The whole body of the worm is marked by fine transverse lines or rings. After a short exposure to the air the color of the parasite changes to a dark, dirty white.

Fig. 43.—Ascaris lumbricoides.

The usual habitat of this worm is the upper part of the small intestine, but their migratory habits are marked, so that they are led elsewhere. Occasionally they travel into the lower bowel, to the stomach, vagina, appendix, the eustachian tube, etc. Expulsion generally takes place per rectum, but it is not unusual to see them expelled by vomiting.

Of this worm and its egg it may be said that, above all other

varieties, it must be seen to make the diagnosis positive. The symptoms are so indefinite, being almost entirely reflex, and varying with the migrations of the parasite, that a diagnosis is usually only made by exclusion. This is later confirmed by treatment. The production of an excessive amount of intestinal mucus is so often associated with the presence of this parasite that its existence should always excite suspicion.

Teniæ (Tape-worm).—This may inhabit the bowels of children of any age; nurslings are not exempt, and cases have been reported as occurring in the newly born. It is not essential for diagnosis that the different varieties of tape-worm be recognized, so that mention will only be made of the common characteristics.

They are all similar to each other in that they grow by segments, the different segments constituting a chain. The smallest segment is that which is nearest to the head, and that one is so minute that it is invisible to the naked eye. Growth is accomplished by the addition of segments to the head, so that the retention of the head upon the mucosa of the bowel means the continued development of the worm.

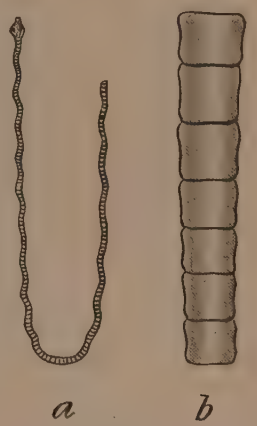

Fig. 44.—Teniæ—(*a*) head and first segments; (*b*) middle segments.

The upper part of the small intestine is the usual situation for the worm. Full attainment of growth is generally accomplished in from eight to twelve weeks, and then there begins the throwing-off of the segments, which may be detected in the stools. An occurrence of this kind makes the diagnosis simple, provided that no undue haste is shown, for it is not infrequent that mucoid stools are mistaken for segments of the worm.

The symptoms are very indefinite and are usually those of a persistent malnutrition despite a ravenous or a capricious appetite. Anemia is usually marked and there are apt to be indefinite abdominal pains and attacks of gastro-intestinal disorder which cannot be clearly accounted for. Microscopic examination of the feces may be made in cases where there is much doubt; this will reveal the ovum if the worm be present.

THE CRY AND THE VOICE

THE CRY

Crying is not expressive of the emotions until near the end of the third month of life, and about this time tears are observed to accompany the cry. It is a matter of interest to observe that the tears, perspiration, and a free flow of saliva all appear at about the same time of life.

A lusty cry directly after birth is a most welcome sound, not alone as a sign that the most difficult stage of labor is terminated, but it indicates the undoubted respiratory vigor of the infant.

Weak, feeble cry at birth, or absence of any crying at this time, is at once indicative of—(*a*) the general feebleness of the infant, (*b*) pulmonary atelectasis, or (*c*) congenital heart lesions. The first is self-evident, the second being indicated by lividity and infrequent or absent respirations, and the last by the general pallidity and weak fluttering heart.

Loud cry, occurring several times during the day or night, arising suddenly and stopping just as suddenly, especially after the expulsion of gas from the stomach or bowel, is strongly indicative of colic from indigestion. During the act of crying the infant is very apt to throw its legs about or to rub them violently together, but this is not any more characteristic of this cry than it is of any violent crying spell. If due to colic, it is at once relieved by an enema, and the evacuations may give evidence of feeble digestion. If the same character of a cry is present with a rise of temperature to 101° F. or over, it is proof that we are not dealing with a simple dyspeptic colic, but that there is some associated condition.

Continued loud cry, with a stiffening of the body and the head being thrown backward, may be due to one of two things—temper or acute pain. The first is very rarely seen before the fourth month of life, and is apt to occur under similar circumstances. To properly diagnose the latter cause, it is necessary to examine the infant and its surroundings for the cause of the dis-

tress. Loosened pins and the bites of insects are a prolific cause. If the pain is relieved by the ingestion of food, but after a time returns again, it is evidence of some digestive condition causing the pain.

Continued, suppressed cry should attract attention to conditions in the head, the abdomen, or the chest. If pain is caused by the use of the abdominal muscles or those of the chest, the child will try to suppress all motion. If venous stasis increases pain in the head, the infant will refuse to move that member freely, and tries to suppress the cry.

Continued but low cry may indicate several conditions:

(*a*) With loss of weight, but no appreciable rise in the temperature, the voiding of a much lessened amount of urine, and, as a rule, with constipation, indicates that the infant is hungry. This may be corroborated by an examination of the milk, or testing what effect upon the condition a feeding or two with a modified milk will have. When the cry has been due to a chronic state of hunger, one such feeding will make the child restful. Sometimes the infant may vigorously suck the fingers, but this is not a constant feature.

(*b*) When more forcible an hour or two after nursing and associated with occasional attacks of colic, it indicates that the cause is chronic intestinal indigestion.

(*c*) With progressive prostration (which is more marked in young infants) and with a tone to the cry which is a sort of a thin, crowing, quacky sound, points to the existence of retropharyngeal lymphadenitis.

(*d*) With progressive emaciation and the cry being quite hoarse in character would suggest hereditary syphilis, if there was a persistent rhinitis of a more or less severe type and an old look to the face of the infant.

(*e*) After the subsidence of the acute symptoms of several diseases, as cholera infantum and chronic ileocolitis, there may be a low continued cry which is almost a moan; but this cry occurs too late to be of any special value.

Short violent cry may be due to several factors:

(*a*) Occurring at night, in an older child who awakes suddenly with fright, it is indicative of night terrors. If the child inva-

riably gives the same cause for the nightly attacks over a long period, it indicates a tendency to epileptiform seizures.

(*b*) Increased upon pulling at the ear or by movements which affect the head suggests the probability of inflammation of the ear. In the presence of an acute inflammation of the ear the mere act of sucking will cause pain and this type of crying. There is usually some elevation of temperature.

(*c*) With a shrill character and following or associated with the act of coughing or sneezing, it points to acute pleurisy.

(*d*) When very piercing in its character, very sudden in its onset, and almost simultaneous with the act of vomiting and associated with marked prostration quickly following, it should lead to an examination for intussusception.

(*e*) While in a somnolent condition it is evidence of hydrocephalus or hydrocephaloid.

(*f*) Occurring during defecation (due to actual pain) or just previous to the act (dread of pain), and associated with persistent constipation, it is almost certainly due to fissure of the anus. The same thing happening during the act of urination indicates that there is a spasm of the bladder, the passing of some fine calculi, or it is occasioned by phimosis. The administration of appropriate treatment quickly clears up the first, the examination of the diaper shows evidence of the second, and examination of the penis clears up doubt as to the latter.

Crying which occurs only when food is offered would indicate that the child was unable to nurse (and this might be due to causes in the nose or mouth or to faults in the apparatus used in nursing) or that nursing caused pain. The cry of acute gastro-enteric infection is of a restless type, with intervals during which the infant sleeps quietly, but these last only a few moments. In pneumonia the cry is apt to be short and catchy. In meningitis we may encounter a sharp, piercing, nocturnal cry, but this is true also of chronic bone disease. In marasmus there is a continual whine; the child is seldom at ease.

THE VOICE

The voice in this section will be considered as an articulate sound emitted from the mouth and consisting of one or more distinct syllables.

Loss of voice and hoarseness are both dependent upon some interference with the normal functions of the vocal cords.

Acute.—In nearly every instance the cause will be found to be some inflammatory condition of the larynx; the ordinary catarrhal inflammation being the most common, and next in frequency come those which are the result of diphtheria, rubeola, and variola. The prolonged use of the voice is sometimes responsible for it, but this is unusual in childhood. A deep, hoarse voice associated with a harsh cough may be the first indication of post-diphtheritic paralysis.

Chronic.—Hereditary syphilis should be the first thought, for it so frequently is at the root of these cases. Other than this, one must remember the possibility of cicatricial stenosis and impacted bodies in the larynx.

Nasal Voice.—This may be of two kinds—the open nasal and the closed nasal.

The open nasal is due to non-closure of the nasopharyngeal opening by the soft palate. Usually the cause is a paralysis, and generally this is post-diphtheritic. Syphilitic ulceration is a possible but a rare cause. Congenital cleft palate causes it.

The closed nasal is due directly to nasal stenosis. When acute, it is indicative of coryza or the introduction of a foreign body. It accompanies follicular tonsillitis, pharyngitis, and retropharyngeal lymphadenitis. Chronically, it indicates adenoids, but hypertrophic rhinitis and polypus may cause it.

THE COUGH

There are two broad divisions which we may make of the symptom cough, and these are those which are respiratory (due to some inflammation of the trachea, larynx, bronchi, lung, or pleura usually) and non-respiratory coughs (which are due to all other causes). Of the non-respiratory coughs, there must be included all coughs due to the various deformities and inflammations of the nasal cavity and of the pharynx, which act reflexly in causing the symptom of cough. Then there must be included irritations of the tongue and diseases of the ear and irritations of various portions of the body which are responsible for the act of coughing. In young children habit plays an important part in the persistence of a cough.

The act of coughing is produced by a reflex mechanism and the avenue of conduction is usually through the pneumogastric nerve. The act of coughing is started with a more or less deep inspiration, which is immediately followed by a contraction of the respiratory muscles, which forces the air against a closed larynx. The force of the current of air is sufficient to separate the vocal cords, permitting the air to escape with much violence, and this constitutes the act. The soft palate shuts off the nasal cavity, so that the offending material, if there be any, is brought into the mouth.

The amount of stimulation which is necessary to produce the act varies widely with different individuals, and this depends largely upon the general state of the nutrition. But it may be broadly stated that acute inflammations of the mucous membranes of the larynx, of the posterior portion of the trachea, and of the bronchi very readily excite the act, while chronic inflammations of these same portions of the body, any disease which lessens nerve irritability, and certain drugs diminish the tendency to coughing.

Under all conditions but one coughing is invariably harmful

to a child; that one exception is when the act serves in clearing the air-passages of offending material. Under any conditions the act of coughing increases intrathoracic pressure, interferes with the free flow of the venous blood in the chest, raises the blood-pressure, distends the lungs, and is more or less exhausting, so that it is readily seen that it cannot but be harmful.

The character of the cough itself is the thing which is of most value in diagnosis.

Dry Cough.—Dry cough occurs when there is some irritation which cannot be removed. It occurs with most frequency during the early stage of acute bronchitis, and at that time may be either slight or constant. The voice invariably remains clear, and this is an important diagnostic point; for if associated with substernal soreness, the diagnosis of acute bronchitis is almost certain without further signs.

In bronchopneumonia the cough is usually incessant and without expectoration, even in older children. A persistent and dry cough with or without a sensation of tickling in the throat is frequently caused by an elongated uvula, and such a cough is generally more severe when the recumbent position is assumed. An examination soon determines this as a cause of the cough, for the uvula is usually found to lie against the base of the tongue.

In the instances in which there is a history of more or less chronicity of the cough following an attack of bronchopneumonia, it is very suggestive of the fact that the process has become chronic. If chronic, dry, and persistent, and with a tendency to become worse during the night, and accompanied with even the slightest catarrhal symptoms in which the eyes participate, it is strongly suggestive of pertussis. A chronic dry cough which is short and noticeably worse at night or in the early morning is indicative of anemia.

Moist Cough.—This character of cough is most typically observed during bronchitis when resolution has set in. In older children it is attended with the expectoration of mucus which is mucopurulent or purulent. The cough becomes moist also in the later stages of bronchopneumonia, pneumonia, phthisis, and pertussis.

Hacking Cough.—A cough with a distinct hacking character may occur in some cases of bronchopneumonia in infants and is not of good import, as the little one's vitality is somewhat lessened by such an occurrence.

A chronic hacking cough which is markedly increased from apparently very slight causes would at once suggest the possibility of chronic pleurisy. A single, dry hack, frequently repeated, indicates one of two conditions—phthisis or a dry post-nasal catarrh. A short, somewhat hacking cough, not so frequently repeated, but persistent in its course, may be due to foreign bodies in the ear.

Laryngeal Cough.—This cough is usually easily distinguished because of its hoarse and dry character. In acute laryngitis it is, as a rule, dry, almost constant, and is exaggerated by speaking, crying, the ingestion of fluids, or upon deep inspiration. It is usually accompanied with either a whistling, metallic, or brassy sound. In chronic laryngeal affections the cough is dry and also hoarse.

Laryngeal cough naturally always indicates some affection of the larynx, and membranous and spasmodic laryngitis are the most frequent ones. Ulceration may cause it, but it is rare in childhood.

Paroxysmal Cough.—This is at once indicative of pertussis, and one should always be suspicious of this disease until it can be absolutely excluded as the cause of the paroxysms. It may be of any intensity and character, and the value of such a cough in diagnosis lies simply in its distinct occurrence in paroxysms. There is no greater fallacy than that which insists that the child must whoop before the case can be considered one of pertussis. While indoors the paroxysms are more pronounced and frequent.

In all conditions in which there is an increased secretion, and particularly that of a tenacious character, there is apt to be paroxysmal coughing until the offending material is expelled. This is often observed in the later stages of bronchitis and of phthisis.

Suppressed Cough.—This is usually due to some painful condition which the act of coughing exaggerates, so that it is seen sometimes during pneumonia, and to a degree in pleurisy, which

is often marked. If a disease which causes coughing is complicated by either peritonitis, abdominal diseases causing pain on motion, or any other such condition, the cough which is present is changed to a suppressed cough.

Cardiac Cough.—This is a short, dry, and hard cough which is worse at night and in the early morning. It is almost identical in character with the cough of the anemic child, but there is a difference, for although children affected with it are pale and haggard and the cough is entirely absent during the day, there is nothing about the child, as far as the respiratory organs are concerned, to suggest a cause, and the other symptoms of anemia (besides the paleness) are absent. Such a cough is usually present very early in hypertrophy and dilatation of the heart. In the later stages there is generally a rather profuse expectoration, which may be blood-streaked.

Inability to Cough.—Either total inability or a marked weakness of the act of coughing may be due to disease affecting the motor nerves, the general musculature, or the central nervous system. Then, again, overstretching of the diaphragm by an accumulation of fluid or by growths may diminish its contractility and so lessen the ability to cough. Inability to cough, when it occurs during either an acute or a chronic illness, is of evil import, indicating impending collapse.

DISEASES WITH COUGH AS A PROMINENT SYMPTOM

Pertussis.—This is a contagious disease which exempts no age, but it is most frequent early in life and especially during the first six years. There are three rather distinct stages—the catarrhal, the spasmodic coughing, and the resolving stage.

The catarrhal stage usually begins with a cough which does not distress or annoy the child. An examination at this time shows nothing abnormal in the chest, but as the pharynx is reddened and inflamed, the case is usually considered as a simple pharyngitis. Quickly following this there is some slight nasolaryngeal catarrh and there may be some rise in temperature (100° to 101° F.). Within a very few days the rise in temperature disappears, but the catarrh and the cough persist. At first the cough

is single, but it quickly loses this character and assumes the characteristic one of repeated coughs occurring in distinct spells, and sometimes the coughs following one another so rapidly that the child cannot properly respire until the spell is over.

The transition of the catarrhal into the spasmodic coughing stage is gradual, and usually by the middle of the second week the coughing in spells is distinctly established. The paroxysms are more severe at night, because at that time the child is usually under conditions which rob it of the free supply of fresh air which it has enjoyed during the day. If the child is kept housed up, the paroxysms are no worse at night than they are during the day, being severe at both times. The influence of fresh air is very noticeable during the summer months, when children with the disease are allowed to sleep near open windows, resulting in a marked reduction in the severity and frequency of the paroxysms.

The cough is usually characteristic in itself; the attack is suddenly violent, the coughs following one another with uninterrupted frequency until there is but little air in the lungs. The child's face is then cyanotic (parents generally describe it as being very red), and the child takes a deep inspiration through a glottis which is spasmodically closed, and the air forcing its way through the narrowed opening produces a loud, stridulous whoop. This may be repeated from one to ten times, and then end with vomiting or the expectoration of a plug of viscid mucus. If the paroxysms are less than ten in twenty-four hours, the disease may be considered mild; if less than fifteen, moderate; and if over that number, it is severe.

After three or four weeks of the second stage there is a gradual merging into that of resolution. In this last stage the paroxysms become progressively lessened, the vomiting ceases, the viscid mucus becomes less tenacious, all of the symptoms improve, and after three weeks the cough has usually entirely cleared up. The tendency now from this time on is to recurrences of pertussis-like coughs from slight causes.

If the pertussis is of moderate or of severe intensity, the face of the child is usually somewhat swollen and bloated looking, and the eyes are suffused, and during the coughing spells may be

streaming. Generally there is more or less conjunctival ecchymosis.

The diagnosis may be difficult at first, and the possibility of mistaking pertussis for pharyngitis has been spoken of. When there is a rise of temperature and the catarrhal symptoms are pronounced, there is a probability of the disease being mistaken for influenza of a mild type. But influenza is not so protracted (the catarrh usually beginning to clear on the fourth day at least), the fever and the cough which are present ameliorate with the catarrhal symptoms, and the prostration is out of all proportion to the severity of the symptoms.

Sometimes in bronchial adenopathy there is a spasmodic cough which simulates that of a mild pertussis, but the whole course and history of the two are distinct. In the former condition the cough begins as a chronic bronchitis (later only does it become anything like pertussis cough), and the physical signs are then so pronounced that there is no reason for error.

If the following points are considered, the diagnosis of pertussis is rendered easy and its differential diagnosis is simplified: (*a*) It is contagious (several members of a family or of a neighborhood are affected usually). (*b*) The catarrh does not extend below the largest bronchi, and the eyes are involved. (*c*) Examination of the chest is negative, despite the severe cough. (*d*) The cough is distinctly paroxysmal, no matter what its mildness or severity, and is made worse by housing. (*e*) The coughing spell usually ends with the expectoration of viscid mucus or with vomiting.

Foreign Bodies in the Larynx or Trachea.—Some children are constantly in the habit of placing articles in their mouths, and at that time a fit of coughing, laughing, crying, or sneezing may result in the escape of such articles into the larynx or the trachea. The lodgment may be in the ventricles, and if so, this will produce coughing which generally quickly results in the expulsion of the offending body.

There may, however, be a spasmodic condition of the glottis induced, and this will result in retention. Other times the article is passed into the trachea or into the bronchus, where there may be an impaction of it. At other times the obstruction may be due not to any article which the child has placed in the mouth,

but lumbricoid worms may be the offending mass, although the migrations which lead them thus far are rare.

The first symptoms are cough, aphonia, and dyspnea. The cough is most severe, and may be so pronounced and so persistent that the child is rapidly exhausted by it. Naturally it is of very sudden onset and almost at once assumes the violence which is its characteristic. The aphonia and the dyspnea both vary in degree with the size of the foreign body as well as with its situation. Sometimes there is a sudden letting-up of all of the symptoms, and this may mean that the body is dislodged or that it has become impacted in some less irritating part.

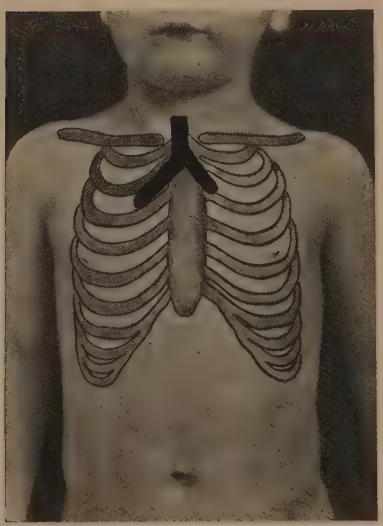

Fig. 45.—Position of the trachea and the primary bronchi. It will be noted that the right bronchus is slightly longer than the left and has a less acute dip.

Usually with the history and the suddenness of the symptoms the diagnosis is clear, but it occasionally offers some difficulties. There may be no history (as when the child is asleep, when the body escapes from the mouth, and when worms are the cause), and the symptoms may not be severe. Then there is danger of mistaking the condition for an attack of acute laryngitis, or if it is mild and more persistent, for laryngeal diphtheria.

If a foreign body is of a very irritating nature or if it is long retained, then it may result in trachitis.

Trachitis is a rare disease and one which is of short duration, when it is not associated with inflammation of the bronchi or the larynx. The chief symptoms are a tickling sensation in the throat, which is accompanied with more or less burning or actual pain upon inspiration of chilled air. There may be some expectoration. Except for the absence of any râles, it cannot be distinguished from a mild attack of bronchitis. The history of a cause is of value.

Acute Bronchitis.—Cough is the essential feature of any bronchitis, and is usually the chief feature. All the other symptoms are of less diagnostic importance, as they differ so widely in their constancy and severity. They cannot be disregarded, for they are important, but nevertheless the cough is the one constant symptom of the disease.

The cough may be constant and severe, or it may be slight, but the voice remains clear in an uncomplicated case. In the beginning the cough is dry and ineffectual. As the symptoms other than the cough are variable and inconstant, I think it advisable to describe somewhat in detail the different types which we observe in childhood, and these are the mild and severe forms in infancy and the mild and severe forms in older children.

Mild Infantile Form.—The onset is gradual and is usually preceded by catarrhal inflammation of either the nose, the pharynx, or the larynx, or, as it is usually expressed by the parent, "the little one had a cold in the head." The cough may not be severe, but is ineffectual and apt to be quite constant. There is, of course, no expectoration at this or any other stage of the disease, as infants invariably swallow any mucus which may be brought up into the mouth by coughing.

The respirations are increased to forty or fifty a minute, and are within a day or two accompanied by a more or less pronounced rattling sound, which the laity describe as "wheezing or rattles on the chest." The infant becomes restless and irritable, owing to the discomfort caused by the disease. The temperature for the first twenty-four or forty-eight hours usually ranges somewhere between 100° and 101½° F., and then subsides to below the 100° mark. At first constipation is the rule, but this is usually quickly followed by a mild diarrhea, with loose greenish stools.

If the infant is one in fair health, and without evidences of rachitis, the general symptoms are always mild, but if weakened from any cause, and especially if the little one is rachitic, there may be higher temperature, more rapid respiration, vomiting, and the development of cerebral symptoms which may prove alarming.

The physical examination usually shows: Palpation—generally

marked bronchial fremitus. Auscultation—the presence of dry, sonorous râles over the whole chest during the first day or day and a half, when they give way to coarse mucous râles which are detectable everywhere in the chest, but are most distinct between the scapulæ and in the infraclavicular region.

The usual duration of this form is from seven to nine days and relapses are common.

Severe Infantile Form.—The onset is generally gradual, with the severe symptoms occurring after a very few days' illness, but occasionally there is a sudden onset. The cough is hard and teasing, but is generally short. The respirations are increased to fifty or seventy a minute, or may exceed this number at times. The temperature is not as high as would be expected from the

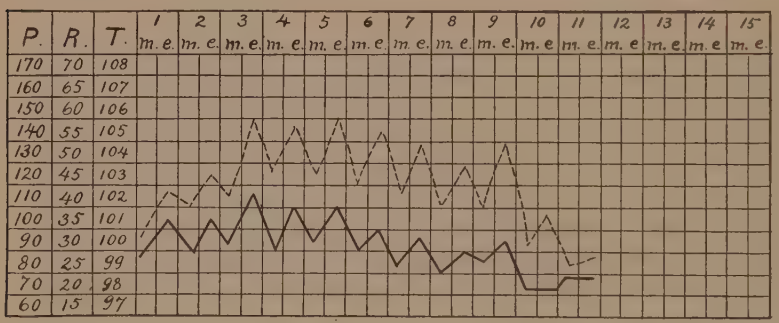

Fig. 46.—Chart of the temperature (—) and respirations (--------) in acute bronchitis. Child ten months old.

evident severity of the disease, and usually ranges between 100° and 102° F., but may increase to 104°.

The general symptoms are severe, and cyanosis is sometimes quite marked in ill-nourished infants and is almost always slightly present in all infants. Dyspnea is well marked, and the relation of the severity of the dyspnea is rather to the respiratory rate than to the temperature.

The physical examination shows: Auscultation—at first the chest is filled with sonorous and sibilant râles, but within twenty-four hours these are displaced by moist râles, which are either fine or coarse, according to the site of their production (the large or the medium-sized tubes). On inspiration the râles are apt to

be quite loud and wheezing in character and respiratory murmur is enfeebled. The râles are heard in all parts of the chest, but their greatest intensity is in the back. Fine râles are the first ones to disappear, and indicate that the disease is coming to an end.

Sometimes the disease appears to be following the usual course, when suddenly there will occur the development of symptoms which, if they do not receive prompt relief, result in the death of the infant. There is suddenly no disposition to cough, and this may be associated with an indisposition to cry also; the pulse becomes rapid and weak, the respiration is even more accelerated and becomes irregular and shallow, the skin is markedly cyanosed, and may be bathed in cold perspiration. Stupor may then come on and be followed quickly by convulsions and death.

The course of the disease is short, the severe symptoms usually persisting for two days (rarely over three days), from which time on there is a gradual clearing up of all of the symptoms. Relapses are not frequent, but extension to the fine bronchi may occur.

Mild Form in Older Children.—The onset is one which shows nothing definite; there may be slight constitutional disturbance for a day, but if there is, it is so slight that no attention is paid to it.

The first thing which attracts attention is the cough, which in the beginning is hard, tight, and exhausting and accompanied by considerable substernal soreness. Such a cough is usually more severe at night. Later on the cough becomes much looser and there is an abundant expectoration of a white viscid mucus which rapidly becomes yellowish and mucopurulent.

The temperature is normal or there may be an insignificant elevation, and there are no general symptoms of any moment. Auscultation shows coarse râles, which are at first dry and then rapidly become moist and are heard over both sides of the chest. The usual course is from eight to ten days, and the tendency of neglected cases is to run into a subacute form which persists sometimes for weeks at a time.

Severe Form in Older Children.—The onset is rather sudden, and with the rapid appearance of a hard, tight cough which is associated

with substernal soreness. There is usually a chill, which is followed by an elevation of temperature which at first may range from 101° to 104° F. The temperature generally reaches its maximum height within the first twenty-four hours, and then persists for two or three days. Expectoration is a very early occurrence and is usually very abundant, the first ejected material being blood-streaked, as a rule.

The general symptoms are severe, while the temperature is much elevated. Auscultation shows coarse râles, which are similar to those observed in the mild form, but they are associated with fine râles also, which are at first dry but rapidly become moist. Wheezing râles are heard on inspiration.

The diagnosis of acute bronchitis is usually easy. Catarrhal inflammation or irritation of the mucous membranes of the trachea, the pharynx, and the bronchi is always associated with cough, so that one must distinguish these in the early stages. If upon examination of the chest there is found no dullness, then we are reasonably certain that we are dealing with bronchitis, pharyngitis, or a reflex cough. If the posterior pharyngeal wall is absolutely normal and there is absence of any rhinitis, then we know that the trouble is not in the pharynx (it is necessary to exclude the rhinitis, for mucus flowing down over the pharyngeal wall will excite troublesome cough). All of the causes of reflex cough must then be considered and excluded as factors.

Next to the occurrence of cough, the most important datum is given by auscultation. Both dry and moist râles are heard in the chest. At first we have the sonorous and the sibilant, being replaced later by fine or coarse moist and bubbling râles in the stage of abundant secretion.

To go more into detail, these are indicative as follows:

If coarse and sonorous râles are heard, then the larger bronchi are involved, because râles of that type are formed in cavities or tubes with a large caliber.

On the other hand, there may be absence of appreciable râles when the secretion is very small. In such instances dependence is placed upon the character of the cough and the fever until other symptoms develop. If it is possible to detect substernal soreness, then this aids very materially in the diagnosis.

If the affection is of the medium-sized tubes, then dry and moist râles are always present uniformly. But if the amount of secretion be small, then we depend upon the presence of coarse vesicular breathing and an indefinite respiratory murmur.

When the affection is of the smallest tubes, we may have a whistling respiration because of the narrowing of the tube by inflammatory swelling. When a secretion is formed, small râles are present.

If bronchitis develops during the course of laryngitis or simultaneously with it, then a great difficulty is encountered, for the loud stenotic breathing drowns out every other sound.

If the breathing is much accelerated, then we are justified in suspecting the development of bronchitis. This is emphasized if the cyanosis is more marked than we would naturally expect with the degree of stenosis. The main point is in the beginning, that accelerated breathing is persistent in bronchitis.

A few words in regard to the etiology cannot be out of place, for the consideration of it is sometimes of considerable value in diagnosis. No age is exempt, but the largest number of cases occur during the period of infancy. The explanation is found in the greater prevalence of predisposing and exciting causes at this time of life. These are partly anatomical and largely nutritional. Then, again, bronchitis is the common accompaniment of all of the acute infectious diseases, and is also frequently associated with disorders of the intestinal tract.

Briefly stated, the more common causes are inflammations of the upper air-passages, systemic poisoning from infectious diseases, intestinal disturbances, rachitis, and adenoid vegetations.

Chronic Bronchitis.—If attacks of acute bronchitis are neglected or they are frequently repeated, then chronic bronchitis is apt to supervene. Other than this, it may follow as a sequela to the acute form which accompanies many times the acute infectious diseases, and especially influenza and rubeola. Then all conditions which favor mechanical pulmonary stasis favor the production of chronic bronchitis.

Like acute attacks of the disease, its development is strongly influenced by nutritional wrongs. It is not a common condition, and especially in the very young, in which particular it differs

markedly from the acute form. But, as in the acute form, the constant symptom is the cough. This is persistent and obstinate, and usually much worse at night, sometimes occurring in paroxysms which may suggest pertussis.

Unlike the acute form, there is no elevation of the temperature and no malaise. Although the child affected may be and usually is thin, there seems to be but little affection of the general health. There is generally an abundant expectoration in the morning, and less during the day, of fetid pus or mucopus, and slight colds add materially to the amount expectorated.

The course of the disease is quite indefinite, and there are seasons in which all the symptoms are decidedly relieved for a time, only to recur again. The time of least severity is with the advent of warm, dry weather.

Inspection and percussion yield negative results; the auscultatory signs differ from the acute form in the milder degree of the signs present, and the fact that the chest is cleared after the coughing spell, until the mucus has had time to regather. Occasionally there is an absolute absence of any and all signs.

In the matter of diagnosis it is not always easy to differentiate between chronic bronchitis and tuberculosis. One type of the latter is observed most frequently in children over five years of age, and has as its chief features successive attacks of transient spring or winter catarrhs, general muscular weakness, and persistent thinness of body, the persistence of which finally results in a decided pulmonary tuberculosis of the chronic type. The process is so long-drawn-out that the child is usually treated as a case of chronic bronchitis, and it is not until much damage has been done that the danger of the situation is realized.

In every case which is at all suspicious a sputum examination should be made. This must be done by swabbing out the pharynx as low down as possible, for it is not sufficient to rely upon the child expectorating the material for examination. Even in the presence of a negative result every effort must be used to determine beyond all possibility of doubt the real nature of the disease, and this entails examination and reëxamination of the child, and the exclusion of every other cause of wasting and failure to gain weight and strength.

The persistent absence of fever at any time of the day is in favor of a diagnosis of chronic bronchitis. Chronic bronchitis is distinguished from pertussis by the presence of a somewhat typical expectoration and the history. Reflex coughs may at times offer considerable difficulty, and to detect their origin, every known cause of such must be considered.

Bronchiectasis.—Dilatation of one or more of the bronchial tubes, with atrophic or hypertrophic changes in their walls, is occasionally seen in infancy and childhood. The symptoms are never pathognomonic. Cough is generally a marked symptom and is usually spasmodic or paroxysmal in character and associated with the expectoration of large quantities of fetid sputum. Generally the paroxysms are most severe in the morning or when the position is decidedly and quickly changed. Sometimes the sputum is blood-streaked or there may be considerable hemorrhage.

Dyspnea usually precedes the coughing attack by some minutes, and the free expectoration generally results in marked relief of the dyspnea. The appetite is usually fickle, and the whole condition is one of gradually failing health and increasing cachexia. Sweating at night is common, and the hectic fever associated with all of the other symptoms suggests a tubercular infection. Deformities of the chest may occur.

The examination reveals diminished movement of the chest. Percussion shows dullness over the areas in which there is a large collection of mucus, but these areas are not constant, as a paroxysm of coughing usually results in emptying them at least partially, upon which the dullness disappears or is much lessened. Auscultation reveals râles which are moist and of all varieties.

Positive diagnosis is not usually possible, but the disease must be suspected when a child expectorates large quantities of fetid sputum, particularly in the morning or upon much exertion. In some rare instances, however, the sputum has little odor, and if the symptoms are at all marked, then it is extremely difficult to differentiate such cases at once from tuberculosis. Such a distinction would necessitate sometimes repeated examinations of the sputum for the presence of the tubercle bacilli.

In fact, the only way in which the disease can be positively recognized is by examination of the sputum. If repeated examinations fail in the detection of the tubercle bacilli, then we exclude tuberculosis; if they fail to show the presence of histologic elements of lung tissue, then we exclude gangrene and abscess of the lung.

EXAMINATION OF THE CHEST

The examination of the chest in children is conducted by the same methods as are employed in adults, but there are certain peculiarities, particularly of auscultation and percussion, which must be remembered, or one will be led to wrong conclusions. These will be discussed later, under the respective headings.

By such an examination it is possible to determine the activity

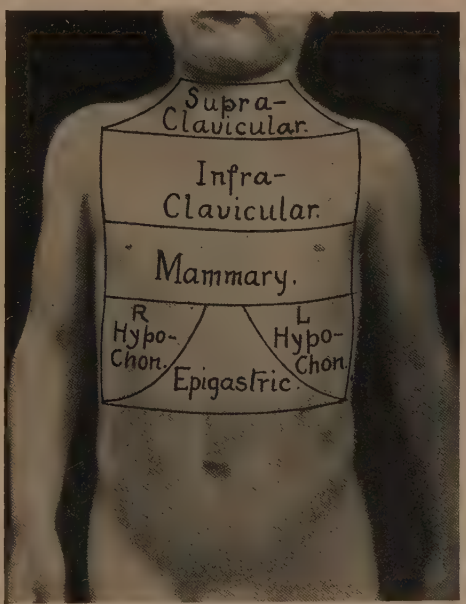

Fig. 47.—Topographic areas of the anterior thorax.

of the movements of the chest and also the physical condition of the parts under examination, but in young children especially too much emphasis must not be placed upon the value of such findings alone; their value is in their association with the general symptoms.

Inspection.—For the proper inspection of the chest the thorax must be bared, and it is best to have the child in a comfortable position, either on the bed or the mother's lap. Note is then made of the shape and the size of the chest, the condition of the covering, and the character of the movements.

The skin and subcutaneous tissues of the chest which constitute its covering should be supple and elastic. The color of the skin may be altered as part of a general alteration in color (see Cutaneous Surface). The subcutaneous tissue should be

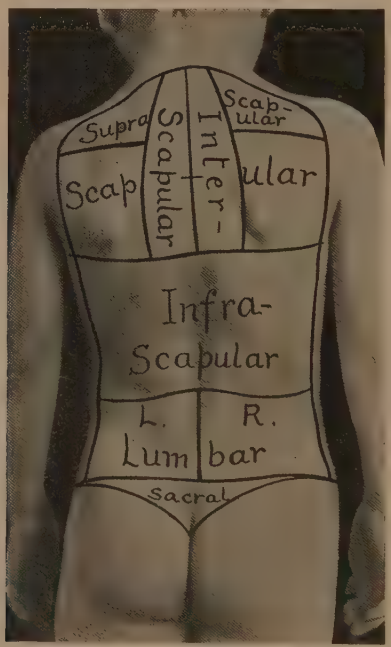

Fig. 48.—Showing the topographic areas of the back.

sufficiently developed to form an even covering, so that the bones are not prominent, an insufficient covering indicating general weakness or malnutrition of the child, and this in turn may be the result of disease.

Shape of the Chest in Health.—This is almost impossible of such description that recognition would be easy; it is only by a method of repeated examinations of healthy chests that one is able to form a clear judgment of what is normal.

Flat Chest.—The name describes the condition; the costal cartilages are straight, and as a result there is a lessened anteroposterior diameter, with a proportionately increased transverse diameter. This type of chest is generally associated with long neck and a general lankiness which are suggestive of a tuberculous tendency. An exaggerated form of flat chest is known as the pterygoid or alar chest, and its indications are similar to those of flat chest, only more so.

Pigeon-breast.—In this chest the anteroposterior diameter is increased, while the transverse diameter is decreased, the sternum being very protuberant. Such a chest is indicative of some long-standing interference with perfect and free respiration, and is generally associated with enlarged tonsils and adenoid vegetations. It may be present to a degree in rachitis, but is not indicative of that disease.

Fig. 51.—Rachitic chest.

The Rachitic Chest.—The chest is shortened and with a more or less prominent sternum. The portion of the chest at the junction of the ribs and the cartilages is depressed, and this tends to force the lower part of the sternum forward to a marked degree. The ends of the ribs are enlarged so that there is a distinct beading felt, and this is called the "rachitic rosary." The costal angle of the chest is generally quite acute.

Funnel Chest.—There is a deep depression of the lower portion of the sternum. This is usually congenital and can often be observed in many members of a family. Its only importance is in its recognition as of no import.

The Emphysematous Chest.—The anteroposterior diameter is increased, the sternum arched perceptibly, the ribs thickened and running horizontally outward, making a wide subcostal angle. It is, of course, indicative of enlargement of the lungs. An error that is frequently made is in mistaking a similar

condition which occurs in kyphosis, but in the latter there is no evidence of disease and the ribs are not thickened.

Unilateral enlargement is usually most noticeable at the base. Generally it is the result of an accumulation of either gas or fluid in one pleural cavity, but it may be due to compensa-

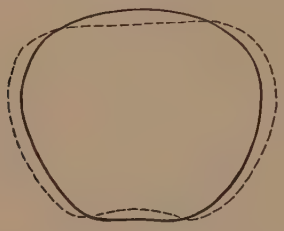

Fig. 52.

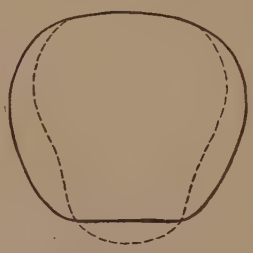

Fig. 53.

Figs. 52, 53.—Comparative chest contours. Heavy solid line, contour of normal chest. Fig. 52: Dotted line, showing the shape of the emphysematous chest. Fig. 53: Dotted line showing the contour of the rachitic chest.

tion on account of disease of the opposite lung. If it is compensatory, the affected lung is smaller than normal. When not due to compensation, the ribs are elevated, the side more rounded, and the interspaces usually obliterated.

Unilateral Contraction.—In this the costal angles are sharper,

Fig. 54.

Fig. 55.

Figs. 54, 55.—Comparative chest contours. Heavy solid line, contour of normal chest. Fig. 54: Dotted line showing unilateral enlargement of the chest. Fig. 55: Dotted line showing the contour of unilateral contraction of the chest.

the planes of the anterior and the posterior portions are depressed, the affected side looking flat before and behind. The ribs are closer than normal. Such a chest is usually the result of pleuritic adhesions, or may result from the collapse of a portion of the lung from a foreign body being lodged in one of the large bronchi.

Unilateral diminution of movement indicates pain which may be due to pleurisy of that side, occlusion of important bronchi on that side of the chest, or that the air-space on the affected side is reduced to a considerable degree.

Each one of these must be recognized by the clinical signs.

TYPES OF RESPIRATION

It will be observed in any given case that one of two large types of respiration predominates. These types are the abdominal and the thoracic, the first of which is normal for the first three years of life, but which at that time rapidly gives way to the latter type.

The Abdominal Type.—As has been stated, this is the normal type in early life. It may be exaggerated by any painful condition in the chest or when there is a mechanical obstruction to free expansion.

The Thoracic Type.—This becomes more and more prominent after the third year of life. When exaggerated, it indicates pain in the abdomen or an interference with the free use of the diaphragm and abdominal muscles. A very superficial thoracic breathing is seen in nearly all cases of hysteria. Pronounced costal breathing, associated with sighing or groaning and without the presence of a stenotic respiratory murmur, suggests at once a commencing collapse of the heart, and it may be the very first indication which we have of that event.

Fig. 57.—Palpation of the chest.

Cheyne-Stokes Breathing.—This is a type of breathing which in a mild form is not abnormal in infancy. The child ceases to breathe, then there follows a superficial and slow respiration which

increases both in depth and rapidity as successive respirations are observed, until there is an acme reached in which the breathing is both hurried and deep; then follows a gradual diminution in rate and depth until the respiration again reaches the period of arrest. This cycle may last for one-half minute or may be prolonged for two minutes. It is most noticeable in tuberculous meningitis, and when it occurs in other diseases, is usually a sign of impending death.

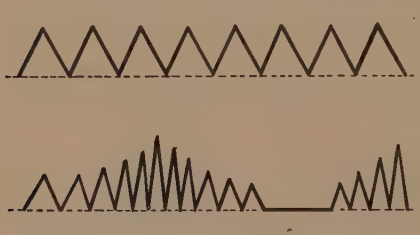

Fig. 58.—Diagram illustrative of normal (upper line) and Cheyne-Stokes respiration (lower line).

Sighing Respiration.—This is an occasional slow and deep inspiration followed by a somewhat rapid and audible expiration. It is observed during collapse and in meningitis; rarely in any other conditions.

Stertorous Respiration.—Snoring is occasionally encountered in healthy children, but its occurrence should lead to an investigation of the nasopharynx, for most often it is due to adenoid vegetations. It is part of the condition of coma and is observed with marked frequency in concussion of the brain.

Fig. 59.—Illustrating the worthlessness of the ordinary phonendoscope in the examination of the chest of an infant. The broken lines indicate the spine. The solid line indicates the lower border of the left lung, showing that most of the lung is covered by the instrument.

Stridulous Respiration.—When a creaking, whistling, harsh, or screechy noise accompanies inspiration, it is known as stridulous breathing. It is always due to some laryngeal condition, and is of such import that it is discussed in detail under a separate heading (see Laryngeal Stenosis).

Palpation.—When palpation is performed, the hands should be previously warmed and the part palpated should be bared. By this method there is a confirmation of the results of observation or inspection, the vocal fremitus is determined, the consistency of parts ascertained, and the presence of fluctuation detected.

Vocal Fremitus.—During early infancy it is only possible to obtain vocal fremitus by the cry. It is increased when consolidation is present, so that it is noted in pneumonia and in tuberculosis when the cavity has thickened walls. It is diminished when there is anything intervening which diminishes the normal conductivity of the vibrations, so that diminution is most often observed when there is a cavity filled with fluid and in thickened pleura. It may be absent when a bronchus is completely occluded, when there is much accumulation of fluid or of air in the pleura, and in some cases when the thickening of the pleura is marked.

Fig. 60.—Position for examination of back of chest. The child can be perfectly controlled by the nurse in this position.

Bronchial fremitus is when vibrations are transmitted by the passage of air through the fluid or mucus which may be contained in the bronchial tubes, and these are felt during inspiration. They are common to all cases of bronchitis, being felt all over the chest, and in asthma they are also noted. The distinctness is sometimes so marked in bronchitis that it is the one thing which appeals to the parent, and they usually designate them as "the rattles."

Friction fremitus is felt in inspiration and increased by deep breathing. It is indicative of pleuritic inflammation.

Percussion.—Many times the chests of young children are asymmetrical, and if percussion is performed over the side with

the most marked convexity, a duller sound will be obtained than upon the opposite side. If the position of the child is faulty (bent toward one side, instead of lying, sitting, or being held in a straight position), one side is much duller than the other. This applies with equal force to the examination of the chests of children with spinal curvatures. If the muscles of the chest are strongly contracted from any cause, and this is generally the result of pain, or may be because the child insists upon keeping the arm raised over the head, there is dullness which is noticeable over the contracted muscle.

Fig. 61.—Illustrating an incorrect method of auscultation of an infant's chest. The tubes of the stethoscope are twisted and the position of the examiner favors congestion of the auditory apparatus, thereby interfering with perfect appreciation of sound.

If the child is crying at the time of the examination, percussion must be performed with short, quick strokes until the time of deep inspiration, otherwise dullness is the only thing obtained. Owing to the elasticity of the child's lungs, percussion should be performed with very light strokes. Owing to the natural rebellion of the child, percussion should be delayed as late in the examination as possible.

Auscultation.—Whenever possible, the back of the chest should be the part examined with the stethoscope. When the

ear is used in auscultation, one is never sure of the exact spot examined, as the child usually is making efforts to avoid examination. Then, again, the surface to be examined is so proportionately small and the movements of the chest so rapid that the use of some instrument is really necessary.

If the child cries, it is a good thing, for it is a valuable adjunct to the detection of abnormalities, revealing the vocal fremitus

Fig. 62.—One correct method of auscultation of the anterior chest of an infant.

and bronchophonia, in addition to finer râles and respiratory murmurs, which otherwise would go undetected. Puerile breathing is intensified respiration, but with no alteration in quality or pitch, and this is normal in infants. In children over three years of age it is abnormal, and occurs usually over a healthy lung only when there is disease of the opposite lung which shifts the burden of respiration to the unaffected lung.

DYSPNEA

Dyspnea is really difficult or labored breathing, and there is usually a sense of breathlessness of which the older child may complain. The respirations are little, if any, increased in frequency, but there is a marked increase in their depth. Occurring during the course of a disease or condition which hastens the frequency of respiration, naturally there is hurried breathing, but this is due to the disease and not simply to the sense of air-hunger. There is more or less cyanosis, and the expression is usually an anxious one. If at all marked, then the lips are parted, the pupils dilated, the nostrils widely dilated, and the skin is cold and wet. The sensation is produced by inefficient exchange of oxygen and carbon dioxid in the tissues, and particularly by a diminution in the supply of the former.

In a general way, the causes of dyspnea are: any obstructive condition of the air-passages resulting in a diminution in the free access of air to the lungs, conditions which hinder free chest expansion (pain is the most common in children), diminished hemoglobin in the blood, and cardiac conditions favoring pulmonary stasis.

Dyspnea upon exertion is usually due to marked anemic conditions, cardiac disease, bronchitis, and pulmonary emphysema.

When anemia is sufficient to give evidences of dyspnea, the symptoms of the impoverished blood condition are so marked that one cannot fail in its recognition.

Chronic valvular disease is of two marked stages in childhood: the first, when compensation is good; the second, when it is not. The first stage is the time that we ought to recognize the disease, for this period may be prolonged indefinitely. Most often its only evidence, subjectively, is dyspnea. What few other symptoms are present have little positive diagnostic value. The slightest

evidence of dyspnea in an apparently healthy child should at once suggest the possibility of its cardiac origin.

In young infants dyspnea is very real in many cases of bronchitis, bronchopneumonia, and the laryngeal affections.

It must not be forgotten that severe dyspnea may be the first symptom to suggest the cause of an indeterminate and obscure severe illness which can be explained upon no reasonable basis until an examination is made of the throat and a retropharyngeal lymphadenitis discovered.

Paroxysmal Dyspnea.—This must not be confounded with dyspnea which occurs upon exertion only, for it occurs irrespective of that. Such attacks are suggestive of either laryngeal stenosis or chronic valvular disease of the heart.

Inspiratory Dyspnea.—When the dyspnea is marked on inspiration, but the expiration is comparatively easy, and such an attack comes on suddenly, it is strongly indicative of a foreign body in either the larynx or the trachea. Occurring suddenly and persisting for a few minutes and recurring occasionally, it may be due to a spasmodic condition, laryngismus stridulus, which is indicative of malnutrition.

Asthma.—As this is a disease which has as its chief characteristic attacks of severe spasmodic dyspnea, it will be considered at this time. It is a disease which attacks the child at any age and the infant is not exempt. Like many other neuroses of uncertain origin, the assigned causes of asthma are multiple. In many instances the term is misunderstood and is loosely applied to any form of dyspnea, irrespective of the cause.

Most frequently the symptoms appear during the night-time and with suddenness. They may then last for hours or persist for several days or even weeks. If the persistence of the course is a notable feature, there are exacerbations and remissions which follow one another for that time. The usual course is a nightly recurrence, so that the child becomes quite exhausted.

Sometimes the development of the attack is during the course of bronchitis. But whatever its development, there is one constant characteristic of the attacks, and that is the dyspnea. In the dyspnea the obstruction occurs in expiration; there is diminished respiratory movement, the expiration is prolonged and attended

with a wheezing sound, and the inspiration is short and catchy. The sense of air-hunger may be extreme and the face has an anxious expression, is pale, or may be cyanotic, and the child holds himself rigid in the sitting position. In infants there may be an elevation of the temperature, but in older children it is commonly slightly subnormal.

The character of the chest sounds as revealed by auscultation are not mistakable. They consist principally of sibilant or sonorous râles, more or less musical, and of much variety as regards pitch and intensity, and are heard all over the chest during both inspiration and expiration. In infants moist râles may be present also. Sputum examination shows the presence of Curschmann's spirals, Charcot-Leyden crystals, eosinophiles, and small round bodies like sago grains.

The diagnosis is made from all other forms of dyspnea by the suddenness of the onset, the abrupt termination, the prolonged expiration, the characteristic chest sounds, the tendency to recurrence, and the examination of the sputum. The dyspnea differs from the dyspnea caused by croup, for the soft parts of the neck and the chest do not recede during inspiration, but instead there is evidence of distention of the lungs, which is characterized by the sinking of the diaphragm and a diminution of the cardiac dullness. If the attack develops during the course of bronchitis in a young infant, the diagnosis is made more difficult. Such cases markedly simulate bronchopneumonia. The suddenness of the appearance of the dyspnea without signs in the chest which would account for it, the absence of small râles especially and of fever at times, helps in the exclusion.

Hay-fever.—This is a neurosis which is closely related to asthma, and by some is classed as a form of asthma. I believe that the evidences of the disease are marked enough to allow of its clear distinction as a separate disease. In the United States the disease is most prevalent from August to November. It is not a common occurrence before the tenth year of life and is rare before the sixth year.

The onset usually occurs with gradually prolonged and severe sneezing and a sensation as though the nose was being tickled. The mucous membrane of the nose, throat, and eyes becomes

more or less acutely inflamed and there is an abundant discharge. More or less severe pain is complained of and is referred to the head, face, and eyes. The general symptoms are those of a mild prostration, there are some slight alterations in the temperature, pulse, and respiration, with usually the final occurrence of an acute emphysema. After several successive attacks the child is usually the subject of asthma, which not infrequently persists throughout the winter months.

Pulmonary Emphysema.—In this condition there is a marked shortness of breath upon the slightest exertion and cyanosis is very easily produced. It is markedly favored during early life on account of the proportionately greater amount of connective tissue which is present at that time, and for that reason it is not unusual to find it frequently accompanying the diseases of the lungs in infancy and early childhood, and particularly when the condition is acute.

There are two groups of cases: those which are the result of the effort of the lung to compensate, on account of disease, and those cases which are dependent upon obstruction to expiration.

When the condition occurs during the course of some acute disease, there is an exaggerated resonance upon percussion. Outside of that there are no symptoms which are peculiar. Under any condition, when pulmonary emphysema occurs, there is, upon percussion, an exaggerated resonance and the areas of cardiac and hepatic dullness are sometimes markedly diminished. This is because the lung encroaches more upon these areas than it does when conditions are normal.

Auscultation is variable, but in most instances there is a somewhat prolonged expiratory murmur which has a low pitch. There are, of course, the associated signs of the primary disease. With the encroachment of the lung upon the cardiac area, there is naturally more or less obscurity of the heart-sounds.

Usually after the termination of the original disease there is a subsidence of the pulmonary emphysema, and although it is never entirely cleared up, the subsidence and improvement are marked in a few weeks.

LOBAR PNEUMONIA

This disease, which is an inflammation of the lungs due in the majority of instances to the pneumococcus, affects the child at any age, and may even be congenital, the infection occurring through the placenta of the mother. The disease always has an acute course with a sudden onset, with high temperature and rapid hepatization, and when typical, with a crisis on the sixth to the eighth day. Hepatization may affect the whole of a lobe of the lung or almost all of it.

There are cases which run a very much shorter course in which every symptom is modified or is very mild, so that the whole duration of the disease may not exceed three or four days at most. The only way in which the mild and atypical types differ from the typical is by the variations being indicated by the different character of the concomitant symptoms and by the course of the disease.

One anomalous type which is not at all uncommon is that in which all the symptoms are marked and typical for the first seventy-two hours or so, and then there occurs a sudden and complete clearing up of all signs of the disease, the affection not going beyond the stage of congestion.

The onset is uniformly sudden, and in children over six or seven years of age it is accompanied with chills, as in adults. In younger children there is some condition present which approximates that of the chill, so that we observe frequently a convulsion, or coldness of the extremities, and cyanosis which is most marked about the lips.

Irrespective of the age, one characteristic of the disease is its rapid onset with high temperature (103° to 107° F.), and this onset is not preceded by bronchitis or other disease essentially, but is independent of all such conditions. Vomiting is a very common occurrence at the onset, and when the weather is warm, diarrhea is usually added.

If the child be old enough to complain intelligently, headache and muscular pains are fairly constant features at the onset, and upon the first or second day of the disease pain in the side, which is increased by the act of coughing or of deep inspiration, is complained of.

If the child be under the age of five, then the pain in the side is usually not evident, but instead it is referred to the loin, to the epigastrium, or to any situation to which the intercostal nerves are distributed. Such pain is generally moderate and of short duration, but may at times be so intense as to suggest conditions outside of the chest as the cause. There is one feature about such pain—that it is never exactly located.

In infancy, if one observed evidences of abdominal pain with vomiting, the possibility of lobar pneumonia should at least be thought of, for at this age gastric disturbances are usually not accompanied early by abdominal pain. It is a safe rule for the diagnosis of the disease, in any event, to suspect its occurrence whenever there is a rapid rise of temperature associated with

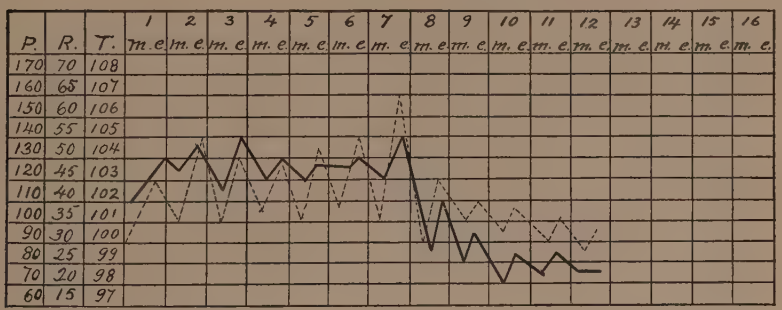

Fig. 63.—Chart of the temperature (—) and respirations (- - - -) in lobar pneumonia. Child one year old.

markedly increased respirations. And if a short dry cough is present, and also vomiting, coated tongue, etc., the diagnosis is strengthened.

While increased respirations occur as a natural consequence of a rise in the temperature, dependence may be placed upon its value only as there is a *marked* increase. It is out of all proportion to the increase in the pulse-rate, which normally is about one to four, but which in this disease may be one to two. The respirations are usually jerky (if pain is caused by breathing), and are accompanied by a short moan or a short sighing effort, which is characteristic only if associated with the other symptoms (as it may be observed in dyspnea from other causes).

Prostration is generally an early and very noticeable feature, as is evidenced by the child giving up easily and becoming exhausted. The pulse is in the beginning full and frequent, but soon becomes weak, small, and compressible, and sometimes very irregular. Even upon the very first day of the disease the symptoms are sometimes such that the diagnosis can be made without waiting for definite physical signs.

In considering the value of Weill's sign (that there is a lack of expansion in the subclavicular region of the affected side, irrespective of the situation of the lesion), I have found that it is present in a very large proportion of the cases at some time, and is an early sign in a majority of all cases, so that it allows of an early recognition of the conditions present.

Lobar Pneumonia (I).

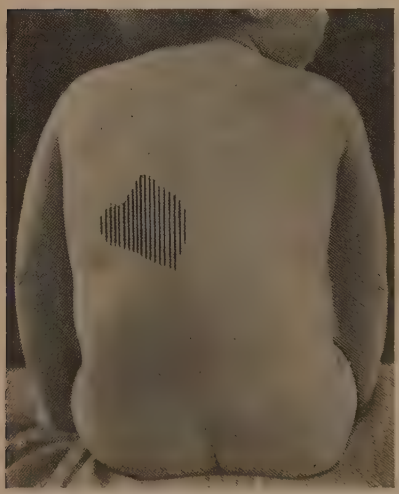

Fig. 64.—Part (or all) of one lobe is congested ( ); slight dullness may be detected over this area, or there may be only diminished resonance. Crepitant râles and feeble respiratory murmur exist over affected area. All healthy lung is hyperresonant.

It is usually not until the second day of the illness that cough is present, and then it continues throughout the course of the disease. It is short, dry, and restricted until the time just before the crisis, and in children who are old enough to expectorate there is usually then an abundant expectoration of brownish-red or yellowish secretion.

After the first rise, which is characteristically abrupt, the temperature becomes more or less remissive, with daily fluctuations of one to two degrees, until the time of the crisis, when there is an abrupt fall. The urine is naturally scanty and high-colored, and may have traces of albumin through it. Cerebral symptoms may predominate for a time, so that we may observe those which are suggestive of the typhoid state or those which are more suggestive of meningitis.

The Physical Examination.—One must not expect to find signs exactly similar to those in adults. If the peculiarities of the child's chest are not taken into account, the examination will prove misleading instead of conclusive.

The earliest percussion signs which we would look for are those which are due to the acute congestion. In consequence of this condition, less air gets into the affected area and more is forced into the healthy portions of the lungs, so that there is usually, over the affected area, a diminished resonance with an exaggerated resonance elsewhere. This sign, however, is not in any way conclusive. Percussion may even fail to outline the affected area, either because the area is limited in its extent, is covered with healthy lung, is deep-seated, or because a gas-distended stomach or intestine interferes with the examination.

LOBAR PNEUMONIA (II).

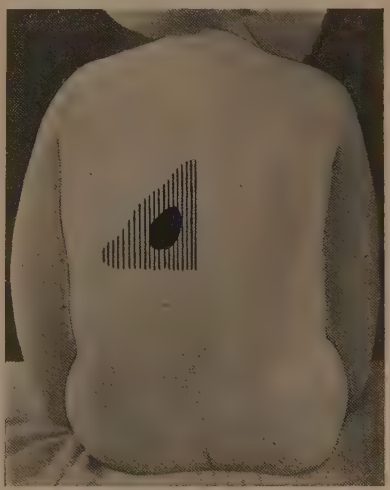

Fig. 65.—Congestion increased and in center of affected area, pure bronchial breathing may exist; dullness still remains slight (in solid black).

At the onset, auscultation, which is valuable in adults, is valueless in children, because they will not breathe deeply on account of the pain. Usually the first auscultatory signs are a feeble respiratory murmur over the affected part, with rather high pitch, while healthy portions may show exaggerated sounds. The latter may be mistaken for bronchial breathing, but it differs in no way from normal breathing, except in its intensity, and is heard upon inspiration only.

Bronchial breathing is still higher in pitch, and is heard with nearly uniform intensity upon expiration as well as inspiration. When consolidation occurs, percussion exhibits marked dullness over the affected area, with exaggerated resonance elsewhere. Auscultation shows bronchial breathing and bronchial voice over the affected area, and this is clearly and sharply defined. Râles

may be observed or there may be pleuritic friction sounds present.

With the advent of resolution all the signs of consolidation gradually lessen, and as far as percussion is concerned, the most persistent signs are slight dullness or diminished resonance. The breathing becomes bronchovesicular, with the latter element predominating. Moist râles of all varieties are heard. There may be persistence of dry friction sounds, or of respiratory murmur, which is more feeble than normal and slightly higher in pitch (accompanied with slight percussion dullness or diminished resonance).

Lobar Pneumonia (III).

Fig. 66.—Consolidation (solid black) complete in the second stage with dullness marked; congestion more wide-spread; some râles or friction sounds.

The diagnosis is usually not difficult, for the sudden onset with the characteristically high temperature, disturbed pulse-respiration rate, cough, expiratory sigh or moan, and the physical signs are sufficiently marked not to mislead.

The sudden onset with vomiting might lead to the suspicion of scarlet fever or tonsillitis as the cause. Scarlet fever would be distinguished by the appearance of the characteristic eruption on the day succeeding the abrupt onset, or, in those cases in which there is little or no eruption, the history of exposure and the presence of sore throat would suggest its possibility, and later, when the physical signs of pneumonia should appear, the evidence would be conclusive.

An acute tonsillitis is much harder to differentiate unless there is a clear history of such attacks occurring previously and the local signs are marked, for it is upon these latter that we depend for an early diagnosis.

During the first day, in infants, an acute gastro-enteritis may

be suspected, for vomiting and diarrhea are so common at this time; but when pneumonia is the cause, the temperature and the prostration are both out of all proportion to the mildness of the intestinal condition.

If during the first days of the disease a dull percussion sound is detected over the inferior lobe of the lung, there may be a question as to its being due to pleuritic exudate. Moderate exudate may give dullness, but associated with it there is a weakened vesicular breathing and not bronchial respiration, as in pneumonia.

If herpes are present on the lips or nose, then pleurisy may be almost conclusively excluded, as herpes is so rare in pleurisy and so common in pneumonia. Vocal fremitus, which is so valuable in adults in differentiation, is of no service in this instance in the child. Dependence must be placed upon the character of the fever, the course of the disease, and the physical signs.

In lobar pneumonia the fever is characteristically high (higher than in most other diseases), while in pleurisy there is not so sudden an invasion, but the temperature takes considerable time to climb to any very marked height. In pneumonia there is an end by crisis in a few days; in pleurisy there is lysis and persistence for three or more weeks usually. The physical signs in pneumonia correspond to the affected lobe and appear almost at once over the whole surface, while in pleurisy, dullness appears in the lower portion of the lung behind and then slowly increases upward before it is detected anteriorly, the upper border anteriorly always being lower than that posteriorly.

If, even under such examination, the cause of the symptoms remains in doubt, an exploratory puncture may be made.

It is a safe rule, and in fact a very necessary one, to suspect the lungs whenever there is a rapid rise of temperature with much increased rate of respiration. This would lead to examination and reëxamination of the chest until the diagnosis of the disease present was sufficiently clear. And a hasty examination of the more prominent parts of the child's chest is not sufficient unless the disease is very typical, for pneumonia in children with obscure symptoms has a remarkable tendency to locate in the more ob-

scure portions of the chest (as high in the axilla or just beneath the clavicles).

Occasionally, at the onset of a lobar pneumonia, the physical signs are not in sufficient evidence to allow of a diagnosis, and the constitutional symptoms which may be present (vomiting, possibly convulsions, delirium, stupor, and even opisthotonos) suggest meningitis. In some of these cases it seems as though the symptoms were designedly deceiving. The symptoms are so suggestive of meningitis from the very start that some authors class this form as a cerebral pneumonia.

The cerebral symptoms are apt to differ to a considerable extent according to the period of life—infancy or later childhood. In infancy there is a sudden onset, usually with vomiting and quickly followed by convulsions and semi-consciousness. If the convulsions are not repeated, the semi-consciousness is of short duration, and the disease then in no way differs from its usual course; but if repeated convulsions occur, then the child is for days in a stupor. Other cerebral symptoms then appear under the influence of passive hyperemia of the brain, so that one may observe rigid neck muscles, dilated pupils, possibly strabismus, or temporary facial paresis.

In the form as it attacks older children convulsions are absent and the somnolent and indifferent condition of the child is more suggestive of the typhoid state than of meningitis. The tongue may be dry and coated. Delirium is usually present at night and the urine and feces may be voided involuntarily. Added to this, there are occasionally rigidity of the neck muscles, a general hyperesthesia, and constipation, possibly with sunken abdomen.

In all such cases the character of the fever is important; that is, in lobar pneumonia there is a constantly high temperature, so that in the presence of a morning and an evening temperature of 104° which has developed suddenly, meningitis would practically be excluded. Such a sudden development with convulsions is peculiar to but one form of meningitis, the purulent, and there is usually abundant evidence as to the cause for its development.

In pneumonia if the convulsions subside even for a few hours the mind of the child clears quite rapidly, which is not true of meningitis. In pneumonia also the pulse is not slow and intermittent

at first, nor is the respiration somewhat slow and irregular, as so often occurs in meningitis. Meningitis exhibits a more profound stupor and a steady increase in the nervous symptoms for three or four days, while in pneumonia they may be very marked during the first twenty-four hours, but generally quickly subside as the pneumonia develops.

A safe guide to the correct diagnosis is this: without paying too much regard to the variety and severity of the symptoms, if nervous symptoms are present from the onset and are marked, meningitis may reasonably be excluded. If they are present at the onset in a mild form, but show a steady increase in severity, or if not present at the onset but appearing later and steadily increasing, then meningitis is to be suspected and not lobar pneumonia. This reasoning holds true even in the presence of pneumonia, during the course of which meningitis is not an unusual complication.

In the form attacking older children, in which the symptoms at first are those of the typhoid state, the history of an initial chill would almost positively exclude typhoid fever, and the early occurrence of the somnolence and typhoid symptoms so quickly after the first signs of illness would at least be very suspicious of pneumonia and decidedly against a diagnosis of typhoid. At most, one could not possibly remain long in doubt, for the tardy physical signs would eventually show themselves. The diagnosis from bronchopneumonia is considered under that disease (see page 224).

BRONCHOPNEUMONIA

This disease is essentially one of infancy and early childhood, being quite uncommon after the seventh year of life. In a great many of its aspects it is impossible to decide whether this affection should be classed as a distinct disease or not. It seems to be a combination of two or more diseases at times. Clinically, there is a decided element of mixed infection, with a complexity of symptoms which constantly change as one elementary lesion or another finds prominence. In its multiplicity of forms there is one common lesion, however—capillary bronchitis.

If all its varied phases were to be considered separately, there would be created an indefinite number of forms of the disease,

which would be confusing. Capillary bronchitis, while it may give no evidence of a pneumonic process during life, should be classed as a form of bronchopneumonia, because while recognition of such a process (pneumonic) is not detected during life, it invariably is at autopsy. One of the chief differences between this disease and lobar pneumonia is that the former is invariably preceded or accompanied by symptoms of catarrh of the small bronchi.

There are many predisposing causes of the disease, the chief ones being the age of the child (infancy) and the state of the nutrition (malnutrition). Naturally any disordered condition of the nutrition of a chronic nature is a factor in the etiology; as marasmus, rachitis, syphilis, etc. Other predisposing causes are poor hygienic surroundings, changeable climate, the cold season, the aspiration of foreign substances, the infectious diseases, and so forth. With one or more of these present, it means that the exciting factor (infectious organisms commonly present in the nose, mouth, or throat) need only be slight to start the process. Of all the single conditions or diseases which predispose to the disease, bronchitis leads.

As has been stated, the one common lesion is capillary bronchitis, and the inflammation involves the whole thickness of the tubular walls and invades the surrounding tissue. By spreading to the alveoli, there are formed small inflammatory foci, and as the disease advances several of the formed areas of hepatization may coalesce, forming larger foci. Now, clinically such a process gives evidence of itself at first by symptoms which indicate a capillary bronchitis with fever.

The mode of onset is as varied as most of the other features of the disease, and may be gradual or very sudden; the temperature may be high or remain only slightly elevated throughout the whole course of the disease; the cough may also be very hard or very slight, and so one might go on and enumerate nearly every symptom. The only certain thing about the disease is its remarkable uncertainty.

The commonest form of development is that which comes during an attack of bronchitis, when it is noticed that all the symptoms or most of them are intensified. This intensification is par-

ticularly observed in the temperature, which may exhibit an elevation to 103° to 106° F. While the temperature is high, it is subject to considerable fluctuation, and sometimes shows a daily variation of from four to five degrees Fahrenheit. In rare instances it may assume a nearly continuous type.

Low temperatures are very apt to be the rule in delicate children, and this is particularly true of infants suffering from marasmus. Dyspnea is very real and is an early and constant symptom, being easily induced by the acts of crying, nursing, coughing, or, in fact, any excitement. Associated with the early occurrence of dyspnea there is the presence of more or less abundant small râles, particularly in the lower portion, behind.

Bronchopneumonia (I).

Fig. 67.—Coarse sonorous râles (O) at first are detected over both lungs or over a limited area. Feeble breathing over limited area with addition of fine sibilant (oo) râles indicates commencement of first stage.

Cough is a much more constant feature than it is in lobar pneumonia, and at first it is dry and hacking, but may have a whistling character, terminating with a short, sharp cry, indicating pain. The persistence of the cough materially disturbs the little one's rest, adds to the general discomfort, and may excite vomiting. No expectoration is present in the very young.

The respirations are always much increased, and, as a rule, are between fifty and one hundred to the minute, and associated with dilatation of the nostrils and sinking in of the soft portions of the chest, as is observed in severe dyspneas.

The Physical Examination.—It is somewhat characteristic of the disease that it exhibits appearances of hepatization first in the back, but on both sides of the spine, and consonant râles may be heard there (if the disease is diffuse) for a considerable period without any sign of distinct dullness. In fact, for several days per-

cussion may reveal nothing but hyperresonance. The amount of percussion dullness is exceedingly meager in proportion to the extent of the consolidation, and if much dependence is placed upon it as an indicator, it will prove misleading. Frequently it is not obtained until the third or fourth day of the disease. It cannot be too frequently reiterated, or too forcibly impressed, that bronchopneumonia may exist in a child and run its full course without the signs of consolidation having been present at any time during the disease. This is true even of some of the cases in which the disease runs a protracted course. The result is that auscultation is of much greater value in the recognition of the condition.

BRONCHOPNEUMONIA (II).

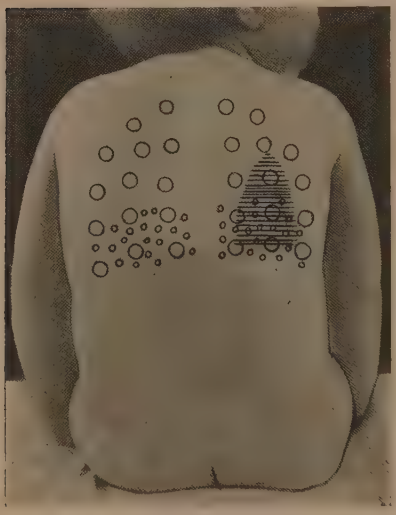

Fig. 68.—Coarse râles increase in extent; fine moist râles are heard over enlarged area and are more localized, more superficial, louder, and higher in pitch. May be partial consolidation (═══).

There is feeble breathing at first over the affected area on account of the congestion. With this are found coarse sonorous and also fine sibilant râles, which are soon replaced by the very fine moist râles. These are somewhat definitely located in the lower lobes, posteriorly.

The respiratory murmur is enfeebled and assumes a higher pitch. Everywhere else in the chest (except lower portion, behind) there may be found coarse râles which have persisted and are due to bronchitis of the larger tubes. In many instances these are all the signs which are obtainable throughout the disease.

The next change is generally that the fine moist râles are heard over a much enlarged area and are more strictly localized at some one point, and this is usually over one lower lobe, posteriorly, and close to the vertebral column. At this place the râles are found to be louder, higher in pitch, and apparently more superficial. Over

such an area there is bronchovesicular and enfeebled respiration, and as the consolidation becomes more evident, bronchial breathing becomes more and more pronounced.

The areas of consolidation are not, as a rule, sharply defined, and are at first small, with an extension until nearly all of one or both lungs, posteriorly, give signs of involvement. Bronchial breathing is pure over the center of the consolidated area, but there are râles at the edges. Friction sounds are rare. In the later stages of the disease the evidences of the bronchitis persist often over the entire chest, but most markedly or entirely behind, the coarse and finer râles intermingling.

Convalescence is indicated by the gradual disappearance of the signs of consolidation and the persistence of râles of all kinds and friction sounds perhaps for two or more weeks.

Bronchopneumonia (III).

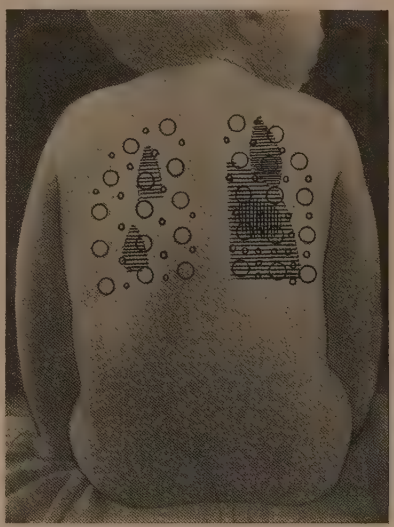

Fig. 69.—The area of partial consolidation increases and other small areas are found scattered over both sides. There may be complete consolidation (▩) near the center of these areas.

Even with its variable symptoms the diagnosis of bronchopneumonia is presumably made if, in an infant, we observed a high temperature with marked daily fluctuations, associated with much increased respiration, cough, and dyspnea, and positive signs of other disease being absent.

From bronchitis it is distinguished by the more marked intensity of all the symptoms, except the cough (which is usually worse in bronchitis), so that during the course of bronchitis if there is an intensification of symptoms, we suspect the development of bronchopneumonia.

Of much importance in the distinction is the presence of real dyspnea, which is not present in bronchitis. Subcrepitant râles

which are heard at the base of the lung and increased percussion resonance are indicative of bronchopneumonia. If instead of being diffuse, as they are in bronchitis, the râles show a tendency to limitation at certain points, the diagnosis of bronchopneumonia is probable.

The distinction from lobar pneumonia is usually easy, for in that disease the inflammation at once occupies the lung tissue without a preceding bronchitis, and from the very start a whole or almost a whole of one lobe is affected. It occurs in later childhood usually and in previously healthy children. The onset is with well-defined symptoms, suddenly developed and running a typical course. Bronchopneumonia is mostly bilateral, and the favorite situation is the lower portions of the lung, behind, while lobar pneumonia is unilateral and shows no preference for the lower part of the chest, affecting the upper portions quite frequently.

Bronchopneumonia (IV).

Fig. 70.—During resolution, the areas of complete consolidation disappear; the partially consolidated areas decrease and are scattered with gradually disappearing coarse and fine râles over both sides.

In lobar pneumonia the temperature at once is high, and with considerable oscillations maintains the same level for several days, ending with a crisis, but in bronchopneumonia the temperature is not so suddenly developed, nor does it rise to such a height, and when high remains so only for a short time (a few hours), exhibiting considerable variations daily, which may amount to four or five degrees Fahrenheit. The termination is by lysis, which lasts from three to seven days.

When the course of a bronchopneumonia is protracted for several weeks, the question at once arises whether there is a tuberculous process present or not. This is especially the case if there have

been the formation of bronchiectasiæ and upon examination large, consonant râles are observed with cavernous respiration. To correctly differentiate these two diseases advantage must be taken of every possible facility to determine the family history and every other factor which might prove of value.

Physical signs are not sufficient for the diagnosis, for in both conditions they may be similar; and in many instances the etiology seems to be the same. The onset of tuberculosis is usually gradual; it may have been apparently sudden, but a careful consideration of the history will generally show beyond all doubt that for weeks before there have been symptoms present which would indicate a tuberculous infection, but these have been overlooked at the time.

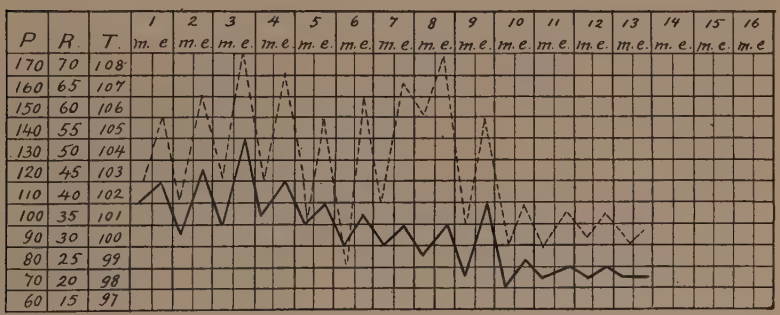

Fig. 71.—Chart of the temperature (——) and respirations (- - - -) in bronchopneumonia. Child one year old.

When the development is sudden (apparently) there is nothing in the physical examination or in the constitutional symptoms which will aid in the differentiation except that at times there is a loss of flesh which is disproportionate to the severity of the symptoms. No positive diagnosis is possible until the time of expected resolution in bronchopneumonia, and then instead of its occurrence we are sometimes confronted with a persistence of symptoms which at once suggests the possibility of tuberculosis. No reliance can be placed upon the character of the temperature. Examination of the sputum is of little value, for in children under six or seven it is almost impossible to obtain the proper material for an examination. Wasting which is out of proportion to the severity of the

symptoms and the presence of a marked anemia are indicative of tuberculosis.

Tuberculosis is usually developed anteriorly at first, and bronchopneumonia posteriorly. If the condition has developed insidiously, during the convalescence from one of the acute infectious diseases, it may be bronchopneumonia, but the strong probability is that it is tubercular. Occurring during the course of pertussis, it occasionally happens that a bronchopneumonia will persist until the pertussis has completely run its course.

Generally speaking, it makes but little difference how irregular the course, or how persistent the disease present, if a thorough examination shows beyond all doubt that the child was previously healthy, that there is no family tuberculous history or probability of infection, that the surroundings of the child were good, and that the disease developed under the influence of one or more of the usual etiologic factors of bronchopneumonia, then tuberculosis may be excluded as the cause. It is very evident that there cannot be complete certainty as to the exclusion of tuberculosis in these protracted cases, because, in the presence of some tuberculous predisposition it may complicate the original disease.

There is always danger of diagnosing bronchopneumonia when the true condition may be malaria, and this is especially true if the malaria has been preceded by a bronchitis or if the onset is accompanied with congestion of the lungs, as it sometimes is. It is impossible, under such circumstances, to make a diagnosis without watching the temperature for some time. In bronchopneumonia there are remissions of the temperature which may be marked, but there is never an intermittence, as in malaria. Enlargement of the spleen would favor the diagnosis of malaria if the enlargement was marked, but not otherwise.

The effect of proper treatment would aid in the distinction of the two diseases, but the demonstration of the plasmodium malariæ in the blood would settle all doubt as to the presence of malarial infection.

Congenital atelectasis would at times offer considerable difficulty in its distinction from bronchopneumonia during the first three months of life (after that it rarely, if ever, gives symptoms). But atelectasis may be eliminated as the cause if the child has been well

and vigorous from the time of birth, and if, at the time of birth, there was no difficulty experienced in getting the infant to breathe. In atelectasis the physical signs are absent or doubtful and cyanosis is not proportionate to the lung involvement, but is excessive.

PLEUROPNEUMONIA

If there is an excessive degree of pleurisy present in a case of pneumonia, then the condition is classed as a pleuropneumonia. While pleurisy is present in greater or less extent in all of the pneumonias of childhood except the hypostatic form, it follows the severity of the pneumonic process quite closely, and until it become excessive and predominates, the disease cannot be considered as pleuropneumonia. It then modifies very much all of the other symptoms, and the two processes combine to form one clinical type of disease.

The constitutional symptoms are all much intensified in pleuropneumonia, and it is this fact that usually serves to distinguish the affection. Even considering the severity of an ordinary pneumonia, the child in this disease exhibits the appearance of being much more seriously ill. The temperature is more constantly high, the prostration much earlier in appearance and greater in degree, the embarrassment to respiration is greater, and the thoracic pain is generally much more intense than in pneumonia. It is the severity of the constitutional symptoms which should at once lead to a physical examination, upon the results of which the diagnosis of pleuropneumonia depends.

For the first two or three days the pleuritic friction sounds are characteristically prominent, and although after that the signs of consolidation are usually clearly defined, loud friction sounds still persist. When the exudate is abundant, the signs are less clearly defined, for there is an intermingling of the signs of consolidation with the signs of an effusion, and the examination at this stage may for a time be misleading. However, if the preceding history has been kept clearly in view, this will not be the case. Percussion exhibits marked dullness and possibly flatness. Bronchial voice and bronchial breathing indistinctly are in evidence, and vocal fremitus is diminished or absent altogether. Sometimes there are present coarse, crackling, pleuritic sounds.

As regards the extent of the different signs, they vary; that is, they may be found over the whole of one lung, they may be limited to a single lobe, or more often are found posteriorly only. The signs may be confusing for a time, and there is only one thing which clearly distinguishes them from the signs which are present over fluid—that is, that the heart is not displaced. Puncture reveals nothing, as a rule, but by accidentally going into one of the many small pockets of pus, a few drops may be withdrawn.

HYPOSTATIC PNEUMONIA

This is a disease which develops directly as the result of an enfeebled circulation and a prolonged continuance in one position or continued decubitus. It develops in the course of some debilitating disease. The condition is very similar to that which is presented by bronchopneumonia, in that both are generally bilateral and show a special preference for development at the lower portion of the lungs, posteriorly.

Hypostatic pneumonia develops in this situation because of the position which the child assumes, and as dependent parts suffer, the back is almost always the site of the disease. The condition is not one which is, strictly speaking, inflammatory. In the beginning there is an embarrassed respiration or a weakened one, associated with the presence of small râles, and, later on, dullness upon percussion, bronchial respiration, and bronchophony.

In the diagnosis there are two conditions which are present as etiologic factors—weak heart action and prolonged decubitus.

When the heart action is fairly good, but the child has been confined to bed for a considerable period, the only sign of the affection may be the presence of crepitant râles, which are noted in the posterior and lower portions of the chest, upon deep inspiration. To detect this, however, the examination must be planned beforehand, for after two or three such deep respirations the râles are usually absent for a time. A similar condition might be present after the absorption of a large pleuritic exudate, but in that case there is the history of such.

As a rule, when the percussion dullness is at all marked, it is

quite strictly limited to an area which is parallel with both sides of the vertebral column. This condition has led some to describe it as "strip pneumonia," which is certainly a forcible term. The affection usually occupies both the upper and lower lobes.

If percussion dullness is absent (as is usually the case), then, in the same situation in which it is usually found, there may be detected only some fine moist râles, and if these are present and are associated with a clearing-up of the râles upon one or two deep inspirations, and this has occurred in a child who has been long confined, then the diagnosis of hypostatic pneumonia is reasonably certain, and the satisfaction is obtained of recognizing the condition before, and not simply at autopsy, as is usually the case.

PLEURITIS

This disease is not uncommon during the first five years of the child's life. It is closely associated with pneumonia, being almost constantly secondary to it, and as any chronic state of malnutrition predisposes to its occurrence, it is commonly observed during and after the devitalizing and infectious diseases of early childhood. The disease occurs in two forms—the dry and the exudative.

The characteristic sign of the former is the friction rub, which is exactly similar to that which is observed in adults, but which in children is far from being as constant. It is heard during both inspiration and expiration and over a very limited area. If the stethoscope is pressed firmly over the part, there is an increase in the sound, but coughing fails to change its intensity or character.

When exudation takes place, then there are signs of dullness on one side of the chest. This is at first noticeable posteriorly and in the lower portion of the chest, whence it spreads gradually upward and then finally forward, the level in front always being lower than that behind.

Usually the onset is very abrupt, but at times the occurrence of the disease is so insidious that it is not discovered until the time that considerable exudation is present. There is an elevation of the temperature which is not violent, but which is generally developed gradually to about 102° or 103° F., and then continues

with marked morning variations, ending by lysis in about three weeks. If the exudation be abundant or purulent, then the course may be protracted for six or eight weeks.

As has been stated, the friction rub is not a constant feature in children, and usually it is not observed in the beginning of the disease, but later, when absorption is taking place. The pain which is present in most cases prevents the child taking a full and free inspiration, and so one of the best means of demonstrating friction rub is eliminated from the examination. The pain is usually referred to the side of the chest in older children, but in infants, if it is evidenced at all (usually it is not), it seems to be located in the epigastrium or umbilical region. Sometimes the pain is not evidenced unless the pressure of the abdominal viscera upward causes it.

Fig. 72.—Illustrating the point at which friction rub is most apt to be found in pleurisy. (Position of nipple intensified by a circle.)

Cough is a feature of the disease which is present at the very beginning and persists with more or less severity to the end. It is short and restrained. The dry form may occur in children over nine or ten years of age, the same as it does in adult life, but under that age its occurrence is rare, and even then its diagnosis is open to serious question. It is the exudative form that interests us most, on account of its more common occurrence. When the exudate is moderate, there is detected in the area of dullness vesicular but weakened breathing, which gives place to bronchial breathing when the exudate is considerable in amount. If the respiratory murmur disappears altogether, then we know that the compression is great and even the bronchi are involved in the pressure. With bronchial breathing there may be bronchophony.

Vocal fremitus is always weakened. When the exudation increases to such an extent that one-half of the chest is filled, then other symptoms are rapidly added. The child at once assumes and keeps the recumbent position, and upon the affected side, or may refuse to lie down at all. This is so because dyspnea, which is now more or less marked, is increased by the assumption of any other positions.

The pressure of the fluid may obliterate the intercostal spaces and cause a unilateral bulging of the side of the chest. The heart is displaced by the fluid to the side opposite that containing the exudate. The liver and the spleen may also be displaced downward. If measurements are now taken, the affected side is found to expand less and is larger than the unaffected side.

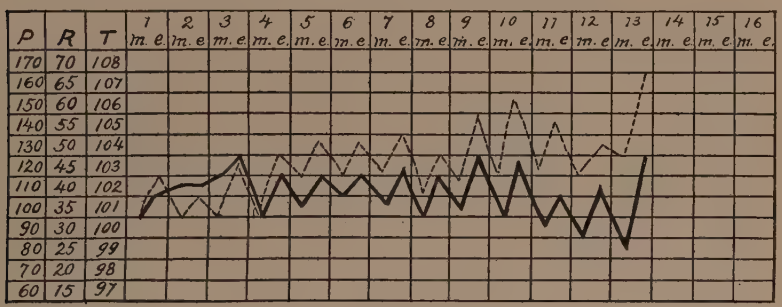

Fig. 73.—Chart of the temperature (——) and respirations (- - - -) in a case of purulent pleurisy with death on the fourteenth day. Child ten months old.

There are observed, occasionally, cases in which the exudate develops insidiously and with such insignificant general symptoms that they are overlooked. The child may have, for weeks before the examination, been getting pale and thin, is readily tired out, and suffers more or less from dyspnea. It is the last symptom which should at once arouse suspicion and result in a thorough examination of the chest and the evidences of the disease are at once marked, for by this time the fluid is abundant.

It is not enough to recognize that an exudate is present—whether it be serous or purulent is very important. If the temperature assumes an intermittent type, if there are daily chills with more or less profuse perspiration, and the child becomes much wasted and pale, then its purulent character is evident.

In those cases which have a remittent fever but an absence of the chills and sweats, the diagnosis is more difficult. Then several factors help one in the determination; the more abundant the exudate and the younger the child, the more probably it is purulent. If the exudate persists for over a month, it is probably purulent. Of the positive signs, there are the following: formation of abscess threatening an opening through the chest wall; sudden expectoration of large amounts of pus; edema of the subcutaneous tissues on the affected side. Exploratory puncture may be necessary to clear up the doubt. In regard to such a procedure, this much may be said: that it is rarely necessary to

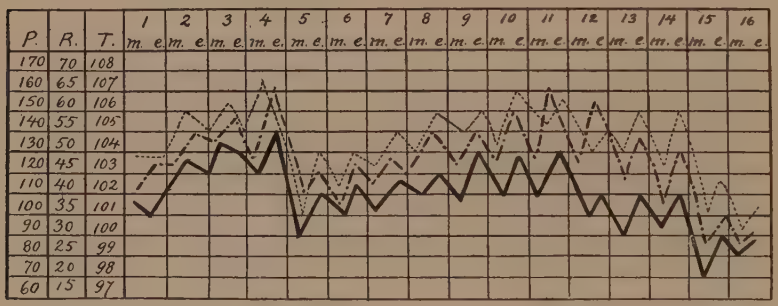

Fig. 74.—Chart of the temperature (——), pulse (----), and respirations (—.—.—) in a case of purulent pleurisy, with operation on the fourteenth day; recovery. Child thirteen months old.

make a deep puncture (two centimeters is usually all that is needful).

Pleuritis must be clearly distinguished from that non-inflammatory condition which occasionally occurs as part of a general edema—hydrothorax. Hydrothorax is almost always bilateral (although more evident upon one side than the other); the cause may usually be found (diseases of the kidneys, heart, or liver, or general wasting); there is no elevation of temperature and no pain; dyspnea and cough are slight, if present at all, and there are the other symptoms of the primary disease.

THE CUTANEOUS SURFACE

The study of the cutaneous surface is made with special reference to the color, the presence of rash or eruption, edema, scars, varicosities, and swellings, also of heat and moisture.

THE COLOR OF THE SKIN

At birth the infant's skin is usually more or less covered with a thick whitish substance (vernix caseosa) which consists of a mixture of epithelium, lanugo, and the product of sebaceous glands. The color of the underlying skin is generally a dusky blue, but after a few respirations this changes to the characteristic "boiled lobster" color of the healthy infant. After three or four days desquamation commences, and continues until about the end of the second week, and it is during this period that the hyperemia is so marked. After that time the skin should assume the characteristic pinkness of infancy.

Pallor.—Pallor of the skin may appear suddenly or be of very gradual development.

Sudden pallor is seen most often under the influence of excitement and of temporary heart weakness, as is observed during fainting, nausea, chills, and certain vasomotor disturbances. Other than this, it occurs whenever there is a large or rapid extraction of blood from the body, so that frequently it is the first evidence which one has of an internal hemorrhage, being followed later by associated symptoms which depend upon the location and extent of the hemorrhage.

Gradually developed pallor may be due to small but continuous hemorrhage or to a reduction in the number of blood-cells and hemoglobin. Such a reduction may be primary and so constitute a disease, or more often it is secondary to some chronic disease. These secondary anemias which cause the pallor are the usual accompaniment of acute nephritis, suppurative processes in

general, tuberculosis of all types, and are especially early in evidence in the course of tuberculous meningitis and rachitis. The pallor of the skin in these cases is associated with other symptoms which are consequent upon an impoverished blood-supply, as, dyspnea upon exertion, muscular weakness, irritable nervous system, anorexia, and constipation.

Pallor of the skin is a common accompaniment of all the anemias, but during childhood it is so frequently the case that this is by no means a marked constant feature that it is well to consider it in a separate section. This will be done subsequently, under the head of "The Anemias."

It then only remains to mention the influence of some of the chronic poisonings, arsenical, mercurial, and malarial, in the production of gradually developed pallor.

Yellow Tint.—Yellowish discoloration of the skin is a sign of jaundice, which is merely a symptom and not a disease. The development of this symptom depends less upon the nature of the disease than upon its location, the essential factor being obstruction to the exit flow of the bile.

Icterus neonatorum occurs in about 60 per cent. of all new-born infants, and the cause is not fully understood. The diagnosis is made by a consideration of the age of the infant, as it begins upon the second or third day of life, upon the otherwise general good condition of the infant, the normal colored feces, and its very benign course.

Icterus gravis of the newly born is always associated with high temperature, rapid collapse, and delirium, and usually has as accompaniments periarteritis or periphlebitis of the umbilical vessels. If there is an obstruction which is congenital, the feces are colorless or gray and the course of the condition is steadily unimproved, so that death usually occurs within a very few weeks, or perhaps may be delayed for months.

When we come to consider the causes of jaundice in children past their infancy, we find that the most common of all causes is catarrhal inflammation. This may occur as a gastroduodenitis, catarrh of the common, large, or small bile-ducts, with swelling of the membranes. Or obstruction may be due to conditions other than inflammatory, interfering with the caliber of the duct.

When due to some catarrhal inflammation, there is more or less pain referred to the epigastrium, the feces are colorless (a valuable guide in the distinction from toxemic jaundice), the tongue is coated, anorexia is marked, and fever moderate. In addition, the urine is usually much darker than normal and the liver enlarged and tender. The bowels may be either constipated or loose. The course of the disease is from a few days to two or three weeks.

Toxemic jaundice is due to the presence of various poisons in the general circulation, and the symptoms are invariably very slight. The mild discoloration of the skin is the most noticeable feature, and is associated with feces which not only are normal in color, but may be darker than usual from an increased quantity of bile. It is chiefly of interest, as it is noticed during the course of some of the acute infectious diseases, especially malaria.

Redness of the Skin.—Unusual redness of the skin is due to hyperemia which may be physiologic, as in blushing, from the reaction excited by warm baths, exercise, or friction of the cutaneous surface, and from exposure to wind, heat, and cold. The erythema of the newly born has been mentioned in the beginning of this section.

Diffused redness is observed during the course of most febrile diseases and is due especially to the very active capillary circulation of childhood. The administration of belladonna or its derivatives may produce diffuse redness, and if the child has an idiosyncrasy, the dose required may be unusually small.

Localized redness is at times characteristic. In older children it is not uncommon to observe redness of one cheek in pneumonia and of both cheeks in pulmonary tuberculosis. Attacks of migraine may at times be evidenced chiefly by a unilateral redness of the face.

Cyanosis.—Because of the thinness of the parts, cyanosis is first observed in the finger-nails, the lips, and the mucous membranes, and is evidenced by a bluish tint or purplish color of these parts and the skin.

The development of cyanosis is favored by the following conditions: (*a*) Those which interfere with free access of air into the lungs. (*b*) Conditions within the lungs which limit its usual oxygen-supplying capacity. (*c*) Conditions which interfere with

pulmonary or systemic circulation. (*d*) Drugs which depress the respiratory center or which cause chemical changes in the blood. One or more of these conditions may be present in any given case.

Generally speaking, the more rapid the development of the cyanosis, the greater the danger to life. The highest grade of cyanosis without a proportionately marked heart insufficiency is observed in congenital heart lesions. Cyanosis of this type is of the greatest value in the diagnosis of congenital heart disease. If associated with loud and diffused murmurs, it is practically positive evidence. The value of cyanosis in the diagnosis of these conditions is very great, but its absence would by no means exclude their existence, for occasionally congenital heart disease is marked without the appearance of any marked cyanosis.

Cyanosis may be one of the most prominent symptoms of asphyxia neonatorum, and especially of that type which comes on after the infant has been respiring well for some minutes. The mucosa is particularly cyanosed, and the face assumes a bloated look. The action of the heart is much weakened. There is always some obstruction to the free entrance of air into the lungs. A circumscribed cyanosis which appears during the cold weather only is evidence of chilblain.

RASHES AND ERUPTIONS

The functions of the skin are so varied and important during the period of development, and there is such a dependence between these functions and those of general metabolism, that every disturbance, whether functional or structural, should receive the closest attention. There is no question of the importance of local causes for local lesions, but even when that is granted, the importance and frequency of constitutional causes is still marked. The more children one sees, the more this fact is impressed. Although few affections of the function or structure of the skin are limited to the period of childhood, yet the very fact that they occur during a period of rapid development gives to them peculiar characteristics, which are not so marked after the first few years of life.

ERYTHEMATOUS ERUPTIONS

Under this heading we will include simple and inflammatory erythemas, whether diffused or localized.

Erythema of the New-born.—This is a perfectly physiologic condition, appearing during the first few days of life. Reference has already been made to it in this section (see page 233).

Dermatitis exfoliativa is very similar to erythema of the new-born, in that there is a diffuse redness of the whole cutaneous surface, the general condition of the infant remaining excellent, but, on the other hand, it is very dissimilar, in that it does not appear earlier than the fifth day of life (more often the eighth), nor later than the end of the third week. Another marked distinction is the course.

In cases which are typical the first sign of redness is on the face, extending within twenty-four hours to the trunk and within forty-eight to the extremities. Usually within forty-eight hours of the first appearance of the redness desquamation is evident, and follows regularly the course of the redness—face, trunk, and extremities.

At first there seems to be simply an unusual dryness of the skin as desquamation sets in, but later there may be exfoliation over large areas, with the underlying skin slightly moist and of a dusky red color. This redness becomes rapidly less dusky, so that within twenty-four hours it is simply a pinkish hue.

The whole course of the disease is about one week, but it leaves the skin with a tendency to the development of other lesions. It is somewhat rare for the redness to become localized, but that may occur. A very unusual course is for the reddened surface to become studded with vesicles containing a clear fluid. These soon break and dry up, leaving no marks of any kind.

Considering the absence of any constitutional symptoms, it does not seem possible that this disease could be mistaken for any other, except erythema of the new-born (and the differences have already been mentioned) and pemphigus. In this latter disease the blisters appear upon normal skin, while in dermatitis exfoliativa vesicles appear over already reddened surfaces. The course of pemphigus is much more protracted. At first a suspicion

might be aroused, when the eruption appeared in an abortive infant, as to the possibility of hereditary syphilis, but the most superficial examination would exclude this possibility.

Erysipelas.—Usually the eruption begins with the appearance of one or more closely adjoining red spots, raised slightly above the cutaneous surface, and accompanied with slight itching, which is evidenced by the child rubbing them. Then, as the redness spreads in various directions, there is added a sense of tension and pain. The appearance becomes rapidly characteristic, with sharply defined borders, markedly reddened appearance, and the more or less tense swelling of the very hot skin. From the central focus there may be various smaller processes over the healthy skin. It is peculiar of this inflammation that its spread is limited by the close adhesion of the skin to underlying parts, so that in those situations in which the skin is abundant in connective tissue the redness is decidedly limited.

Fig. 75.—Lentigo (Winfield).

The acme of the inflammation in the skin is generally reached in two or three days; then there is a gradual declination. Sometimes this is accompanied with a lamellar desquamation, leaving the skin pale. Eight or nine days is the usual limit of the affection in a simple case, but if the disease shows a tendency to general distribution, the course may cover several weeks. Such a course as this latter is termed "erysipelas ambulans." Constitutional symptoms are severe.

The inflammation of erysipelas being so typical, there is practically no chance for error if the whole symptom-complex is in mind. Erythema exsudativum multiforme may exhibit lesions

of limited extent, and the same be associated with more or less severe general symptoms, simulating erysipelas, but the etiologic factors are entirely different, and this is a rather rare condition in childhood. Diffuse phlegmonous inflammation simulates erysipelas more closely than any other condition, as it is characterized by redness and swelling with inflammation, but in these diffuse inflammations the redness is much darker than in erysipelas, is not limited in any direction, and the skin has a hard, board-like feeling.

Erythemas with Strict Localization.—Redness of the skin localized more or less strictly is due to some irritation of the skin, as a rule, and of this the history can be obtained, so that diagnosis is easy. The causes of the irritation may be varied: mustard plasters, local action of iodin, prolonged pressure, irritating excretions or secretions, etc. Another more diffused variety is that due to the action of the sun—caloric erythema. All these are readily diagnosed.

Roseola Æstiva.—In children, with their unusually tender skins, various causes may produce eruptions which may add much difficulty to diagnosis. Etiologically, autointoxication is a most important factor, and in erythema multiforme probably the cause is some infection. The ingestion of certain foods will produce an urticaria in some children, and the rubbing or scratching of the spots will develop papules.

Roseola is an eruption of a deep rose color. The spots are generally about the size of a pea, or they may appear a bit larger, and if so, are apt to be somewhat elevated above the surface. They are rounded or oval in shape. The spots do not appear independently, but are associated with other diseases, and usually those in which there is some febrile process due to infection of some kind.

The rash is not diffuse and has no tendency to arrange itself in any particular order. It is only of interest as it occurs during the course of some of the diseases and makes the diagnosis more difficult. This source of error can be overcome to a great extent if one will refuse to be misled by the appearance of the rash alone, and will only consider it as it occurs with some associated disease.

It is apt to precede variola, scarlet fever, rubeola, typhoid fever, malaria, diphtheria, and syphilis.

Occurring as a prodromal rash in variola, it indicates a mild form of the disease (petechiæ indicating a severe form). In this case it appears either in the form of diffuse redness over varying sized areas, or in the form of distinct spots which resemble rubeola spots but lack their characteristic arrangement. Such a rash lasts from twelve to forty-eight hours (usually the shorter period).

Roseola might be mistaken for the rash of scarlet fever, rubeola, or rubella, and the points of distinction are as follows: (*a*) Roseola is not contagious or epidemic, although it occurs with much greater frequency during some epidemics of the acute infectious diseases than in others. (*b*) There are no prodromata. (*c*) The rash does not follow any definite period or type of fever and is not limited to any special area or location. (*d*) There are no other symptoms besides the rash which can definitely be attributed to it, except a very moderate fever (100° or 101° F.). (*e*) It never appears in the mouth.

The peculiarities of the syphilitic roseola are that it is not associated with any fever and is very chronic in its course, taking a long time to appear and a longer time to disappear. The hyperemia is soon complicated with pigmentation, but one must remember that the pigmentation which gives the so-called raw ham color is similar to that which is produced in all chronic dermatitis.

Erythema Multiforme.—In a simple form this is observed as papules with or without exudation, and, as its name implies, the further course of the rash is mult form. It may disappear within a few hours or persist for two days. If the rash persists for more than a few hours, rings are usually formed, and with the fading of the color desquamation takes place, leaving a few pigmented spots.

There is never any itching or pain, and if fever is present at all, it is only at the onset and then moderately. This rash shows a particular preference for the dorsal surfaces of the wrists and the feet. If the special localization is remembered, and consideration is taken of the multiformity of the rash and its short duration, there is practically no chance for mistaking it.

Erythema Nodosum.—With the erythema there is considerable edema. The eruption is caused by serous exudation into the skin, so that flat elevations are formed from the size of a pea to that of a chestnut. The redness of the nodules is modified somewhat by the color due to venous congestion, so that in most instances the spots look bruised. Occasionally, however, the spots may remain red for a time and fade away without change of color.

The patches develop usually on the legs and forearms, their long diameters being parallel to the long axis of the bones. It is rare to find them in any other situations. The spots are often quite painful, are invariably tender, but never itch. A rise in the temperature when the nodules appear is very common, and this is so even when they are few in number.

Fig. 76.—Pemphigus vulgaris (Winfield).

When the edema is at all marked, the nodules may readily be mistaken for periostitis, but the appearance of nodes upon other remote parts would at once clear up any doubt. The absence of itching would distinguish it from urticaria.

Urticaria.—This is so common during childhood, and is so frequently associated with digestive disturbances, that it has come to be considered as indicative of such. The characteristic eruption is the formation of wheals with white centers and surrounded with an erythematous blush. They appear suddenly, and when conditions are right, may be produced by rubbing or

scratching, so that very often the intense and persistent itching which is characteristic not only is not relieved by scratching, but is intensified by it. Several wheals are formed, as a rule, which persist for a few hours or days. A much less common form is that in which large areas are affected as the result of the coalescence of several small patches. All parts of the body may be affected except the scalp and the soles of the feet, and affection of the face is very rare.

Fig. 77.—Lupus vulgaris (Winfield).

The course may be acute or chronic, and in the latter it is characterized by the appearance of many successive crops running into one another.

Medicinal Rashes.—The diagnosis of these is very easy if a clear history is obtainable, but this is not always the case. Belladonna may cause a rash which is quite similar to that of scarlet fever, but which lacks the minute darker points which are seen in the latter. Antipyrin may be the cause of an eruption which looks like urticaria (but with no intense itching) or like rubeola (without the crescentic arrangement). For other rashes see following sections or index.

Erythema scarlatiniforme and **erythema morbilliforme** are considered where such consideration will be of most service, under "Infectious Diseases."

VESICULAR ERUPTIONS

Medicinal Rashes.—Atropin may at times produce a rash which is vesicopapular and somewhat simulates acne, but such a rash is developed upon an inflammatory base and is much more superficial than acne.

Herpes.—This is evident by an eruption of vesicles arranged in groups or clusters upon an inflamed base or surface, and from the location of the lesion it receives different names, as frontalis, facialis, zoster, etc.

Herpes facialis appears usually upon the lip or the alæ of the nose, but sometimes may appear on the cheek or chin or within the mouth. The appearance is rather sudden and unattended with

Fig. 78.—Zoster of arm and palm of hand (Winfield).

any pain. Within about three days the vesicles dry up, forming thin, small crusts. It is always evidence of some internal disorder, usually a catarrhal inflammation of the respiratory tract or malaria.

Its common occurrence during the course of pneumonia and of epidemic meningitis gives to it a position of quite some value in diagnosis. On the other hand, it never occurs during tuberculous meningitis or typhoid, so that that fact may often be of service in differentiation.

Herpes zoster is another form of the affection which is characterized by appearing over the course of a nerve. Unlike the adult

type, it is not accompanied by neuralgic pain, either during or after the eruption. Preceding its appearance, however, there may be more or less burning feeling over the affected area. The vesicles are at first discrete, finally tending to coalesce, and when undisturbed, they form scabs which, when they drop off, leave the skin slightly reddened.

The duration of the affection is usually about one week.

Sudamina.—This is a form of miliaria in which there is no inflammation. Tiny vesicles appear, looking like small pearly bodies closely set together. Disappearance is accomplished by absorption within a very few days, but fresh crops may appear from time to time. Such a condition may be observed during the course of any fever or when exhausting conditions are present.

Eczema frequently shows vesicular eruption, but as the lesions are so varied, I think that it is best to give it a separate consideration, which will be done later (see page 250).

Varicella is also considered under another heading (see "Infectious Diseases").

PAPULAR ERUPTIONS

Miliaria Rubra.—This is usually the result of overdressing and is a sweat rash. Its common occurrence is upon the neck and cheeks. The eruption consists of red papules which are scattered and sometimes interspersed with tiny vesicles. Itching, if present at all, is very slight.

Miliaria Papulosa.—This is the commonest variety of miliaria and is popularly known as prickly heat. The red papules which appear are very fine and very thickly set. Occasionally there are seen scattered over the eruption tiny vesicles which occupy the summit of some of the papules, or in rare cases there may be minute pustules present. If undisturbed, the vesicles will dry up, and are followed with a slight desquamation.

The appearance of the rash is characteristically rapid, especially upon the neck, back, and chest. The itching which accompanies the appearance is at times almost intolerable, which in a young infant may cause a long train of symptoms. The duration is about forty-eight hours.

From eczema the diagnosis is easy, for miliaria appears so sud-

denly and is of such short duration. It never occurs in circumscribed areas like eczema, being more or less diffused. Another very valuable sign is that sweating is usually very profuse over the portions of the body not affected by the rash.

PUSTULAR ERUPTIONS

Medicinal Rashes.—The bromids produce very frequently a pustular eruption, which appears most often upon the shoulders, chest, face, and arms. The iodids may produce a similar pustular eruption (or the rash may be papular or erythematous), but show a special preference for the face, neck, and arms. The history is usually all that is necessary to clear up the character of the rash.

Gangrenous Dermatitis.—This is a rare condition and is observed almost exclusively in infancy. The eruption is usually first seen as a vesicle about the size of a pea, but this rapidly becomes pustular with a dark-red areola. When the pustules break, crusts form which are very adherent, with ulceration underneath. These ulcers are sharply defined and may coalesce. It occurs only among the most neglected children.

ERUPTIONS WITH THE FORMATION OF CRUSTS AND SCALES

Ichthyosis is usually looked upon as a congenital deformity and not as a disease. It is always hereditary, although not necessarily congenital, and, outside of the hereditary tendency, we know practically nothing in regard to its cause.

Without entering into a lengthy discussion, which would be possible, in regard to this disease, it may be stated that any chronic non-inflammatory condition of the skin which results in the skin becoming dry and parchment-like, while at the same time the flexor surfaces are spared, is ichthyosis.

In the severest form the infant dies within a few days. The epidermal layer of any part of the body may be cracked in irregular shapes, the loosened edges of which turn up like the scales of fish. The scaly skin is of a gray color, with the fissures of a raw red hue.

Occurring late in infancy, the disease is subject to some variations in its intensity, for at this time it is more chronic. The gen-

eral health then has a marked influence upon the disease and cold weather makes it worse.

The course is chronic and without hope of cure.

The diagnosis is easy, although the disease is so rare, because of its typical character and the absence of subjective symptoms.

Seborrhea.—When the sebaceous glands are overactive, the discharged contents gather upon the cutaneous surface in the form of an oily exudate or of dry, friable crusts, and this constitutes seborrhea.

The affection usually occurs during infancy, as seborrhœa capitis, and the anterior fontanelle is generally covered with thin, dry, dirty yellow colored scales which adhere firmly to the scalp. The whole head may become affected, even down to the eyebrows. Under the scales the skin is reddened slightly, but there is no inflammation.

Fig. 79.—Ichthyosis (Winfield).

The occurrence of the affection should lead to an investigation of the state of the nutritive processes, as it most often occurs in infants whose nutrition is faulty or whose general health is poor. The affection generally disappears after the nursing period, but there may be returns of the trouble.

Impetigo Contagiosa.—This disease of the skin is usually not seen until crusts have been formed. At the start the lesions are discrete vesiculopustular ones, but crusts are very quickly formed, so that this latter is the condition for which the physician is generally consulted. The lesions show a preference for the face, and especially the lower part of the same, but they extend by inoculation to the more accessible parts of the body.

The first appearance of the eruption is that of a small, flat, and soft vesicle with a central depression as the periphery extends and

becomes pustular. This may increase until it is about the size of a dime. The contents then are expelled or exude, forming a yellowish crust, which falls off at the end of seven to twelve days, leaving the cutaneous surface but slightly reddened for a time. While the crust remains, it is in strong contrast to the healthy skin. The lesions may coalesce so that, instead of the usual appearance, one sees large patches where the crusts have run into one another. Itching is not a marked feature, but is sufficient to cause scratching, and thereby an extension of the affection to other parts or the formation of ulcerations from the irritation.

The diagnosis must be made by a consideration of the history (contagion) and the extension by inoculation, as well as by the appearance of the lesions. The disease is most apt to occur during the first eight months of life.

Tinea Favosa (Favus).—This is a highly contagious disease and may be contracted either from human beings or from animals. No age is free from it, but it shows a remarkable preference for the young and those of uncleanly habits. The favorite situation for it is upon the scalp, although not limited to that part.

The lesion upon the scalp is usually of circumscribed yellowish crusts with cup-like depressions. These areas extend and the cup-like depressions thicken, until the whole of the scalp may be covered. When the crusts are removed, the underlying surface is devoid of hair, is slightly reddened, and is somewhat depressed. There is present at this time a peculiar musty odor which is quite characteristic of the disease.

Unless the case is very typical in its development and in its lesions, a microscopic examination should be made to find the parasite. The decided yellow color of the crusts will serve somewhat in distinguishing the disease from eczema, which exhibits crusts of a brown hue, but if the case is one of long standing, the color will not be so pronounced; then more dependence is placed upon the occurrence of baldness, which is so prominent in tinea favosa and not so evident in eczema.

The course of tinea favosa is essentially chronic, persisting often for months.

Tinea Trichophytina (Ringworm).—This disease is named, according to the location of the lesions, tinea corporis or circin-

ata, tinea capitis or tonsurans, and tinea unguium or onychomycosis. It is a parasitic disease, due to the trichophyton fungus and other varieties of fungus. The infection of a child may come through human agency or may be directly from animals.

Tinea corporis usually begins as a slightly raised circular spot, with a very reddened surface, and appears upon the parts devoid of hair. From being about the size of a pea, it may extend until it is one or two inches across, and during the process of extension the central portion resumes the appearance of normal skin, while the periphery is a ring of minute red papules and vesicles undergoing desquamation. The desquamation is of a fine, scaly character. Several of the rings may coalesce, forming irregular patches. The lesion persists for several weeks, finally subsiding, while new lesions are formed in other parts.

Tinea unguium affects the nails and is rather a rare condition during childhood.

Tinea capitis is by far the most common form, involving not only the epidermis, but also the hair-follicles, the sheath, and the capillary cylinders. The lesions are circular and increase by peripheral extension. In the beginning attention is usually called to the presence of a circumscribed bald patch, and upon close examination this is found to be an elevation covered with very fine white scales which look like powder. Removal of the scales leaves the underlying surface slightly red in color (or in some instances there is a dusky bluish hue). The surface shows the presence of broken-off hairs, while the hairs at the periphery are lusterless and very dry. There may be some itching. The course of the disease is chronic. Unless the disease is typical, reliance for diagnosis must be placed upon microscopic examination.

Psoriasis.—This disease is milder, easier to treat, and more discrete than the similar condition in the adult. It is of very rare occurrence before the sixth year, so that a consideration of the age is a valued point in differential diagnosis, although one must not forget that in rare instances it may occur as early as the first year of life.

The disease never attacks the hands or the feet, but shows a characteristic preference for the flexor surfaces. It is evidenced by abundant pearly scales which are thickly crowded over the

healthy skin. The scales when formed are very abundant, and when removed leave a bleeding surface.

The differentiation must be made from eczema. The crusts of seborrhea are friable and of a greasy feel, and their removal leaves a pale surface and not a bleeding one, as in psoriasis. The scales of syphilis are of a dirty brown color and are often found upon the hands and feet. Other symptoms of syphilis are so marked that there is practically no chance for error.

LOCALIZED PRURITUS

The administration of the opiates in some children will result in a scarlet rash which is accompanied with intense itching, or more commonly there is an itching which is limited to the region of the nose and unaccompanied with any rash.

Scabies.—This is a contagious disease of the skin due to the burrowing of the female acarus. The favorite situations are where the skin is the thinnest, so that we find the lesions usually between the fingers, on the flexor surfaces of the wrists, in the axillæ, and on the genitals in males. An infant at the breast of an infected nurse may show lesions about the face. The lesion is a papule or a vesicle, more rarely a pustule, and there may or may not be inflammation present. The lesion is due to the formation of the burrow and appears as a fine brown or black line about one-quarter to one-half inch long, with a whitish speck at one end, which is the acarus.

Usually the inflammation which accompanies this is in direct proportion to the general health of the child. The inflammation may be so severe that the parts affected are simply a mass of pustules, and such an eruption on the hands should always suggest scabies. Added to these are lesions which are the direct result of scratching.

The diagnosis is easy if there is obtainable a history of other cases, but without this the characteristic feature of the eruption is the presence of papules, vesicles, or pustules in parts where the skin is thin. A small magnifying glass will rarely fail in the detection of the burrows. A vesicular form of urticaria occurring in infancy may readily be mistaken for scabies, or vice versâ, unless

one has had the chance to see the development of the eruption. Itching is very marked.

Pediculosis.—Pediculosis capitis is very common after the school age, and occasionally it is prevalent among younger children who are neglected. The ova (nits) clinging to the hair may for a time be the only evidence of the presence of lice, which are observed later as minute dark-red spots lying close to the skin, and which when disturbed show much activity. The itching is usually quite persistent and severe.

PIGMENTATIONS OF THE SKIN

Nevi (Birth-marks).—These are of two forms—the pigmented and the vascular. The former consists simply of a circumscribed hyperpigmentation of the skin, or it may be warty and covered with hair. An increase in size may occur as the infant develops. The vascular forms are composed of anomalous blood-vessels of all kinds, and may not be discoverable at birth, but develop later. Their size, shape, and situation are very variable, but in one particular they are all alike—they are obliterated for a time by pressure. When they are developed to a great extent, they are called angiomata cavernosa.

Xeroderma pigmentosum is a very rare disease, beginning in infancy as early as the second or third month, and is distinctly hereditary. The primary appearance of the lesions is similar to ordinary freckles, but the intervening spaces soon exhibit depressions which resemble variola scars. Several areas develop later which show hyperemia, telangiectasis, and soft warty growths, until all the exposed surfaces are the site of some one of these lesions. Ulceration and atrophy follow in a persistently chronic course.

ECZEMA

Eczema is certainly the most important and potentially is the commonest skin disease of childhood. The forms of the affection are various, and principally because there is so much difference in the severity. The disease may properly be regarded as a catarrhal inflammation of the skin with varied developmental changes.

After the age of seven or eight the disease does not show any differences from the adult type, so that its consideration here will be chiefly as it occurs in young children and infants. The sensitive skin of the young child predisposes to its development, and the relation of the disease to gastro-intestinal disorders is also intimate. Anything which renders the natural resistance of the child less strong favors the development of eczema, and if added to this is some slight irritation of the sensitive skin, the disease is apt to follow.

Fig. 80.—Eczema (anterior view) (Winfield).

The ordinary chronic form (**eczema rubrum**) is the most common, and its usual location is upon any part of the face or hands (but it may extend over the body). The appearance of the lesion at first is usually a few small scattered papules which break down and expose a raw and moist surface. This surface exudes serum and seropus, which finally dry up and form thick gummy crusts which may be quite hard. Scratching causes these to bleed readily, and if much blood is drawn, the crusts become a dirty brown color. The skin may be more or less swollen.

If the crusts are removed, the underlying surfaces are red, inflamed, and perhaps granular, or, in more chronic cases, there may be some thickening and induration. The itching is a very marked feature. Swelling of the lymph-nodes about the eruption is a constant feature of the disease when it affects the scalp or face. Both dermal and adenitic disorders may spread indefinitely and are essentially chronic in their course.

Seborrheic eczema is in reality a combination of seborrhea and eczema. The favorite location is the scalp and face at first, whence it spreads to the neck, chest, back, and arms, or to any other part of the body. The primary lesions are usually those of a dry seborrhea with the formation of yellowish crusts. The skin is not thickened nor is there any apparent elevation. Itching is not so severe as in the commoner form, nor is there any extensive weeping surface. The crusts are very soft. The patches are inclined to be sharply defined, although the lesions are not deep-seated.

Fig. 81.—Eczema (posterior view) (Winfield).

Intertrigo is really eczematous only in a potential sense, and is a term which is commonly applied to any eruption which develops upon two moist surfaces which are in contact. Its cause is any uncleanliness, so that it is commonly seen in the groin, the axillæ, about the buttocks, back of the ears, and about the genitals. In the beginning there is a reddening of the skin in a patch or more, which usually becomes exaggerated, so that the upper layers of the epithelium are thrown off and an eczematous process begins. Crusts are not formed, but the itching, tenderness, and pain are all severe, as a rule.

Pustular eczema affects the scalp most commonly, because the conditions are favorable for pus-formation. It is simply an eczema with added infection with septic microörganisms. Itching is not severe.

The diagnosis of eczema does not present as much difficulty as is commonly supposed. Usually the development of the disease is quite typical, so that there is less chance of being misled. In addition to this we observed two very essential and characteristic signs of the disease—considerable itching of the parts and swelling of the neighboring lymph-nodes.

There might be some difficulty in differentiating scabies, for this disease simulates eczema in these particulars—intense itching and multiform lesions. But in scabies there is usually the history of other cases in the families or among the playmates; the parts affected are the flexures of the wrists and elbows, or between the fingers, the axillæ, and, in males, the genitals. A detection of the burrows would clear up any doubt.

Papular eczema of the buttocks might, under some circumstances, be mistaken for syphilis, but the former disease affects the parts near the anus and not directly at the anus. However, it is often impossible to make a satisfactory distinction without going into the history very carefully and searching for other signs of syphilis. The syphilitic eruption does not itch at all, and inflammation is not much in evidence. The eruption also occurs as small circumscribed spots and exhibits a dark color.

PURPURA

This cannot be considered as a disease; it is simply a symptom. By it we understand the existence of a condition which occurs spontaneously, and the chief characteristic of which is transitory hemorrhages of the external skin, mucous and serous membranes, as well as parenchymatous hemorrhages of the internal organs. Purpura simplex includes hemorrhages of the skin alone, while purpura hæmorrhagica includes bleeding into the skin, the mucous and serous membranes, and the internal organs.

Outside of these two larger classifications there are almost innumerable others, which are based upon the associated disease or upon the apparent cause of the hemorrhages, but as all of them finally depend upon a general cause, there is no necessity of considering them separately.

Purpura simplex is, of course, the mildest form of the condition, but one is never certain that it will remain so. It may soon run into the more severe form, and there are no clear marks of distinction in the transition from one type to the other. It is only with the greatest circumspection that distinctions are presumably made. In most instances it is impossible to determine any immediate cause for the occurrence of the condition. It probably

depends upon some internal causes of which we know nothing at present.

The mild form is evidenced by the appearance of extravasations of blood in the skin, which are fine, discrete, pinhead-sized, red spots (petechiæ), which do not disappear upon pressure. These spots are the only clinical symptom. The spots may remain in evidence for a few hours only, or they may persist for several days. When the condition is more severe, then the hemorrhages in the skin appear as small but very numerous dusky red, circular spots, which show much preference for the lower legs and the feet, the arms, and the abdomen. In time these spots undergo the usual alterations in color which are observed in all extravasations of hemoglobin. After a few days they become quite pale, and finally fade away entirely, but there may be several crops of the spots from time to time. The greatest source of error in their differentiation may be from the bites of insects, and especially of fleas, but in the latter instance there are always uniformity of size, central puncture, and sometimes the evidences of itching.

Purpura hæmorrhagica represents a very severe and tenacious form of the condition, for the hemorrhages are almost always extensive and profuse, so that at times the child has the appearance of having been spattered with blood. In this form there is often seen every degree of hemorrhage from a simple petechia to large areas in which the blood has arranged itself in irregular forms. When the mucous membranes are much involved, the nose is usually the first to suffer, so that epistaxis is an early occurrence, being followed rapidly by hemorrhages from the lips, cheek, gums, and palate.

Naturally, one encounters all grades of anemia, with consequent symptoms and results. Occasionally urticaria will develop, and if so, the urticarial spots are the sites of hemorrhages. When the condition occurs, associated with a high temperature, a suspicion might be aroused of hemorrhagic variola. In favor of the disease we have the history of exposure (without the protection afforded by a recent vaccination), and the peculiar fact that when petechiæ appear as a part of the condition which makes the disease hem-

orrhagic, they appear first upon the lower part of the abdomen and the inner aspect of the thigh.

Typhoid might be suspected if fever was present for several days previous to the appearance of petechiæ, but if the character and type of the temperature had been observed, no mistake could reasonably happen. Other symptoms would appear which would not allow of any doubt as to the cause being typhoid.

A very great difficulty will arise, in certain atypical cases, in distinguishing purpura from the hemorrhages which occur during the course of scurvy. In scurvy, however, the hemorrhages into the muscles, under the periosteum, and in the cellular tissue are very frequent, and bleeding from the mucous membranes is not

Fig. 82.—Purpura hæmorrhagica (Little).

apt to occur until very late in the disease; in purpura the reverse is true. The bleeding in scurvy is not strictly from the mucous membranes, but from points of ulceration about the gums, and this ulceration is manifested by swelling of considerable degree and a disagreeable odor. In purpura the mucous membrane remains perfectly normal, although the site of considerable hemorrhage.

There is not only a hemorrhagic condition during the course of scurvy, but added to it is an inflammatory element, while in purpura the hemorrhagic element is pure. Then, again, in the former disease, before the occurrence of hemorrhages, there are well-defined symptoms of a general nature, which point clearly

to some fault in the nutritive processes with a long train of symptoms which are dependent upon the malnutrition and the weakness present; but in the latter condition the symptoms of anemia and weakness, if present at all, follow the occurrence of hemorrhages. If doubt still existed after a consideration of all of the foregoing facts, the history of the child's feeding from the time of birth, and of all of the symptoms past and present, and the effect of the administration of the vegetable or fruit acids would be a valuable aid.

In 1868 Henoch first noticed that purpura and arthritic phenomena might be associated with vomiting, colic, and hemorrhagic diarrhea, and this condition is known as "Henoch's purpura"; and this, with our present knowledge, should be regarded not as a special form, but as a special manifestation of the same transitory hemorrhagic tendency as is observed in all purpuras.

EDEMA

If there is an accumulation of serum in the lymph-space of the subcutaneous connective tissue, it is commonly called dropsy. If such an accumulation is confined to rather small areas, it is termed edema; if the accumulation is very general, and in addition the large lymph-cavities, the pleura, the pericardium, and the peritoneum are involved, then we use the term anasarca.

The accumulations of lymph in the lymphatic vessels and spaces and also in the serous cavities may be influenced by the excessive formation of lymph, by interference with its free escape (or both causes acting together), or by hindered flow of the lymph. The escape of the lymph from the capillaries depends to a great degree upon the differences in pressure between that of the blood in the capillaries and that of the tissue which surrounds them, as well as upon the permeability of the capillary wall.

Edema may be caused by venous stasis, which may, in turn, be merely local (occlusion of the vein), or it may be general, as when due to pathologic conditions in the lungs, to cardiac weakness, to intrathoracic growths, or to exudates (pleural or pericardial). Naturally enough, most of the swelling is in the line of the least resistance, so that elastic tissues and organs suffer most, or,

again those parts which are most dependent. It is for this reason that edema from general stasis shows a preference for the ankles and lower parts of the back.

No matter what the extent of the accumulation, the recognition of the condition is not at all difficult. The part affected is swollen and puffy, wi h a smooth and pale surface which may be very shiny, and upon pressure pitting is observed which persists for an appreciable time. This pitting is most pronounced when pressure is made over some part which has a hard or bony background.

By the occurrence of much edema the natural lines and depressions of the part are all obliterated, and this may amount to deformity of the part. It is quite characteristic of the condition that it is influenced by position, and even independent of this, it shows a tendency to disappear in one part to reappear in another.

Fig. 83.—Mastoid abscess. The characteristic manner in which the external ear is pushed forward by the abscess is here well shown.

From inflammatory swelling it is distinguished by the absence of the classic signs of pain, redness, and heat. Subcutaneous emphysema gives a crackling sound upon pressure, there is no pitting, and this condition is always associated with some disease or condition of the air-passages. As a diagnostic sign its value is influenced by its location, the mode of development, and the disease with which it may be associated.

Local Edema.—This occurs under the influence of pressure upon or interference with venous circulation. It is also a valuable diagnostic sign of inflammation An inflammatory edema occurs because inflammatory processes hinder the free removal of lymph from the tissues and in addition injure the capillary walls.

One Arm.—This indicates some pressure upon the axillary or subclavian veins (or thrombosis of the same), either from injury, tumors, or enlarged axillary glands.

One Leg.—The causes which have been mentioned as affecting the arm may, by corresponding conditions in the groin and thigh, bring about similar conditions in the leg, by causing pressure over the femoral vein.

The Feet.—This may occur in a debilitating or exhausting disease, in which the heart action has become weakened, therefore it is not uncommon during the diarrheas which run a chronic course. On account of more perfect compensation, it is not so frequently an accompaniment of cardiac disease as the similar condition is in adult life. It is very common during all the forms of anemia.

The Face.—This gives to the face a very striking appearance, and is strongly indicative of some renal disease. Its appearance is most marked in the morning. Occasionally it accompanies inflammatory processes in the skin (as in some cases of urticaria). A chronic edema of the face may be due to a remote attack of erysipelas.

Unilateral edema of the face accompanied with some elevation of temperature, but no redness of the skin, may be due to the presence of an alveolar abscess or to parotiditis. If there is an odor from the mouth which is fetid, and the child is evidently exhausted and debilitated, it is strongly suggestive of noma. Edema of the eyelid alone indicates an inflammatory condition of the eye and is not suggestive of renal disease, as is sometimes taught.

The Neck.—Edema of the neck which is painless, without signs of inflammation on the skin, generally means that there is an inflammation of some adjacent organ, and search should be made for periostitis of the inferior maxillary, for diphtheria, tonsillitis, and parotiditis. When diphtheria is the cause, the swelling is usually bilateral; in tonsillitis it is more often unilateral, and in parotiditis the swelling is directly under the ear and characteristically harder in that situation than elsewhere.

The Chest.—If limited to one side of the chest, edema indicates that there is a purulent pleurisy.

Angioneurotic edema is a circumscribed type. Its appearance is sudden, it remains but a short time in evidence, and disappears as rapidly as it came. It is generally preceded by local symptoms of itching, heat, and redness, or by a general urticarial eruption. With the attack there is usually associated some gastro-intestinal disturbance, which may be severe, with vomiting and severe colic as the chief symptoms. The boundaries are sharply defined. The absence of any itching helps to distinguish this from urticaria (if itching is evident it is only before the appearance of the swelling), although the two may be associated.

General Edema

Sclerema neonatorum is a hardening of the cellular tissue which occurs in nurslings. The skin of the legs, and later that of the whole body, hardens, and associated with it there is a general collapse. There are two forms of the disease—the acute, which affects the new-born, and the other (sclerema adiposum), which develops in later childhood (after several months of life). The latter usually develops under the influence of profuse diarrhea. As far as diagnostic value is concerned, there is none, except as the condition gives evidence that the infant is weak or abortive.

Anasarca.—This is in most cases dependent upon disease of the kidneys (nephritis) and is much less frequently due to cardiac disease. However, independent of either of these conditions, it may develop under the influence of general exhaustion, and especially that which follows some acute disease. In this latter type there is no albuminuria and the swelling is generally confined to the abdomen and the ankles, but may extend up the legs.

Myxedema closely simulates dropsy, and the swelling is general. A peculiar characteristic, however, is the fact that the legs are more swollen than the feet and the arms more than the hands, and the swelling of both legs and arms is irregular. There may be several areas of padding. In this condition the thyroid gland is always absent, actually or functionally. The swelling does not pit, but is hard and indurating, and associated with most striking changes in the general appearance. The skin is thick, dry, and rough, sometimes with a gloss to it. There is considerable mental deficiency, which may border upon idiocy.

SCARS AND CICATRICES

Small round depressions or pits upon the cutaneous surface are indicative of a past attack of variola or varicella, and as corroborative evidence of the history of such attacks have some value.

Small irregular scars with a hardened feel may be the result of furuncles, and the favorite situation of these is about the neck. These latter, however, must not be confused with the large irregular scars which are due to scrofulous or tuberculous glands. These latter are almost uniformly depressed and more or less adherent. They show a special preference for the cervical, inguinal, and axillary regions, and in the order named.

Scars of the tongue would naturally lead to an inquiry as to the possibility of injury received during epileptic seizures. Irregular scars at the angles of the mouth may indicate hereditary syphilis.

The value of well-formed scars due to injury or to previous operative procedure, as indicative of such happenings, will at once suggest itself.

THE VEINS

Any unusual distention or overfilling of the superficial veins is easily distinguished. Such a condition may be local or general, and may be preceded, accompanied, or followed by edema, which, if marked, will mask the condition of the veins. While it is usual for edema to follow any considerable interference with a large vein, it does not always do so, for collateral circulation may be well established.

General venous distention depends upon a hindrance to the flow of venous blood. Such a general stasis may be the direct result of cardiac weakness. Stasis in the pulmonary circulation may be somewhat overcome, if it depends upon left ventricle weakness, by an increased action of the right ventricle. Venous stasis from weakness of the right ventricle is not overcome, so that, as a consequence, there is a slowing of the whole blood-current.

Diseases of the lungs or pressure upon one or more of the large vein trunks will cause venous stasis, and if there is increased

intrathoracic pressure from any cause, or a lessened thoracic movement, then the heart receives a lessened flow of blood.

General venous distention is best seen during convulsions and paroxysms of pertussis.

Local venous distention usually depends upon pressure over a venous trunk of considerable size or with an important distribution. The cause of pressure should always be sought for.

HEAT AND MOISTURE OF THE SKIN

When the skin is abnormally dry, its nutrition is impaired, but in regard to the normal moisture of the skin there are marked individual differences. Under similar conditions, the skin of one child will be unusually active, while the skin of another will not be. Still, allowing for these individual traits, the activity of the skin has some diagnostic value.

Increased Perspiration.—This occurs more or less during all fevers, but especially during the course of typhoid fever and tuberculosis, in the latter disease usually occurring most at night. General sweating is apt to be profuse during tetanus. Suddenly occurring and temporary sweating may attend the convalescence from all exhausting diseases and be induced by slight excitement or exercise. As an accompaniment of collapse, the sweat seems to stand out in big drops upon the forehead, and the whole surface of the body is bathed in cold perspiration.

During the course of any febrile disease a sudden fall of the body-temperature is usually accompanied by a suddenly appearing sweat. General sweating, occurring when the temperature is normal or subnormal, indicates general weakness or debility. The sweating which indicates a septic condition appears suddenly with each fall in the temperature and disappears when the temperature begins to rise. Local sweating of the head is very suggestive of rachitis, and for a time may be the only sign to attract attention. Accompanying this there is usually baldness of the occiput.

Diminished Perspiration.—This is the usual occurrence during the early stages of acute febrile conditions, and during the first days of the acute infectious fevers this is a marked feature. Pro-

longed vomiting, diarrhea, or the occurrence of considerable edema predisposes to diminished perspiration.

General Coldness.—This is usually associated with capillary circulation which is poor. It is seen in all forms of rigors and chills, and generally accompanies those conditions which cause cyanosis, so that the two are usually associated. It is one of the marked features of collapse, and may be present in conditions in which there is weakened heart action and no fever.

Local Coldness.—This may be due to vasomotor spasm or to some obstruction to the local circulation.

General Heat.—This may accompany any of the fevers, but is by no means a constant feature of such a condition. It is observed most typically in insolation. In susceptible infants a mild degree of general heat may be occasioned by the use of artificial heat.

Local Heat.—This is one of the cardinal signs of inflammation. When temporary, it may be due to the influence of local applications.

LOCAL SWELLINGS

The swelling due to edema has already been considered. Swellings which are due to the presence of tumors and accumulations of fluid are also considered elsewhere, so that it only remains for us to speak of three conditions—scleroderma, furunculosis, and warts.

Scleroderma occasionally occurs during childhood and should not be confounded with sclerema neonatorum. The development of the disease is very slow. The lesions are local swelling and induration, with either a waxy pallor or dusky redness of the skin, but in either case the surface has a mottled appearance.

The affected parts are hard and feel like tallow, but do not pit under pressure. Later in the disease atrophy occurs, and the skin then becomes tight and adherent to the subjacent structures. The temperature is usually subnormal. The affected parts may at times feel cold to the touch. The sclerosis may be band-like and limit motion to a considerable degree.

Furunculosis.—Boils are common among ill-nourished children. There is one form which is peculiar to infancy in which

multiple boils appear upon any part of the body, but usually the scalp and neck. There are all sizes observed and they occur in crops. Usually there is but little pain and they have no core.

Sporadic furuncle occurs as a local inflammation about a hair-follicle or gland of the skin. The affected part at first tingles, then a small, bright-red papule forms, which is followed by a hard, dusky red, pyogenic process, in the center of which is a core. When let alone, pus forms and usually there is spontaneous rupture.

Warts (**verruca**) usually appear upon the hands and may be congenital or acquired. The growth is a hypertrophy of the papillæ, covered with thickened epidermis.

EMPHYSEMA OF THE SKIN

This condition is due to the presence of air or gas in the subcutaneous cellular tissue of the body. It might be mistaken for edema unless closely examined. Then it is found that there is no pitting upon pressure, but that the swelling yields readily, with a fine crackling sound. Its occurrence may be due to a wound which allows air to be admitted, or it may be occasioned by the rupture of a gas- or air-containing organ, or, again, from the presence in the tissues of organisms which are capable of producing gas.

It is not unusual for such a swelling to spread from its original site and become more or less general. At best, it is a rare condition, and its topographic occurrence is of no importance in diagnosis. Without the definite history of an injury its occurrence is most common during the severe stage of pertussis.

ANEMIA

The present classifications of anemia are usually not definite scientific ones, as our present knowledge does not allow of such accurate classification. The difficulty has arisen chiefly because of our former disregard of the blood-changes which take place.

There certainly can be no anemia without some change in the blood, so that the study of hematology is quite as important as a consideration of the clinical symptoms. Disturbances of circulation particularly lead to erroneous diagnoses, because such disturbances usually cause important symptoms, common also to abnormal blood-composition. These symptoms are chiefly pallor, small pulse with increased rapidity, weakness, and vertigo. Any or all of these may be present under the influence of fear or other nervous excitation, from masturbation, during the various heart affections, from overexertion, and in some of the acute affections of the stomach and intestines.

The presence of anemia, then, is proved only when changes in the blood are proved. Such blood-change in anemia is not singular, but there are several changes which take place. For the purposes of diagnosis it is only necessary to demonstrate one change, and that is deficiency in the hemoglobin.

This deficiency may exist because too little is formed or because too much is destroyed. That the child is especially susceptible to changes in the blood is well established, for the entire developmental period shows that a struggle is constantly going on to maintain blood equilibrium, so that, under apparently slight influences, anemia is induced. Undoubtedly much of this tendency is directly due to the fact that the blood of the infant and young child is low in hemoglobin and in specific gravity, and that the blood-cells are unstable, parting with their hemoglobin readily and upon slight provocation showing nucleated forms.

Added to this is a constant and heavy demand for tissue growth, which works the blood-producing organs to their limit. Every

tissue in the child's body is really a blood-producer, but there are certain organs in which this is the chief function.

We can readily understand that the pathology of the blood is very closely associated with that of every individual organ, for the blood gives and receives material from them all. The composition of the blood, therefore, depends in some measure upon the general condition of all of the organs of the body.

Etiology.—Among the causes of anemia in childhood are:

(*a*) *Hemorrhage.*—This may be the result of traumatism or occur during the course of some disease. If the hemorrhage is excessive (that is, nearly 50 per cent. of the total amount), the child dies with all of the symptoms of acute asphyxia. If the hemorrhage is moderate in amount, the fluid portion which is lost is replaced by fluid from the tissues and from the food. The corpuscles are replaced slowly by the tissues which form them. In the chronic forms of hemorrhage the blood returns to its normal condition more slowly, because the cause is usually still more or less active.

(*b*) *Toxic Elements.*—Intoxications may follow the ingestion of certain drugs, or may accompany the acute infectious fevers, nutritional disorders, organic diseases, malignant neoplasms, etc.

SIMPLE ANEMIA

Extensive observation has demonstrated the fact that in most cases of anemia the normal mode of blood regeneration is preserved; thus we class these as simple anemias. The causes may be an acute, a subacute, or a chronic condition following hemorrhage. Any constitutional or organic disease may lead to the development of anemia, by interference with the keenness of the appetite, by loss of blood, by imperfect oxidation of the blood, and especially through the influence of albuminuria and of suppuration. Toxic elements also play an important part in the production of this form of anemia. But whatever the direct cause, the essential result is the same from all causes—change in the blood.

The most important blood-change is the reduction in the hemoglobin, for this gives us positive evidence of anemia and

also leads to a determination of its degree. In mild cases the corpuscles differ little, if any, from the normal, while in the more severe cases some deviations from the normal are noticeable, and this is true numerically as well as morphologically. Morphologic changes affect both the size and the shape of the corpuscle, the size being somewhat smaller than normal, and the shape somewhat distorted; this is called "poikilocytosis."

Even in the mild cases the changes manifested by staining are usually pronounced. The appearance of normoblasts (nucleated blood-corpuscles of the same kind as those found in normal red bone-marrow, but now circulating in the blood) is not any indication of the severity of the anemia, but they are usually rarer in the mild than in the severe forms.

Of the characteristic clinical symptomatology of simple anemia, pallor of the skin and mucous membranes is the most prominent, as a rule. Such pallor is usually intensified by a permanent constriction of the peripheral blood-vessels. It cannot be stated too forcibly, however, that in childhood pallor is by no means a constant feature of anemia, unless we simply consider pallor of the conjunctivæ and the ears. Muscular weakness and sensations of weakness and fatigue upon slight exertion are due to the same cause as the pallor—deficient hemoglobin.

According to the severity and chronicity of the anemia, the several organs of the body suffer in consequence of the reduced value of their nutrition, so that all of the physical and psychic functions are much below normal. Pallor is particularly marked in the mucosa of the mouth and the conjunctiva; the sclerotics are pearly, the ears waxy, and the whole muscular system is atonic.

The general metabolism is usually not reduced, so that when one finds, as is true in a few instances, that these functions are abnormal, one may conclude that it is not due to the anemia, but to some special cause. Even in severe forms of anemia, the adipose tissue is well preserved, unless there is some complication of a nutritional nature.

Conditions like the above readily account for the almost innumerable symptoms which are traceable to their influence. The pulse is apt to be weak and irregular, and perhaps rapid. Vague pains in the limbs or in any part of the body may be complained of. Res-

pirations are more shallow than usual and dyspnea is evident upon slight exertion. Vertigo and tinnitus aurium and syncope may occur. Digestive disturbances are very common and catarrhal inflammation of all kinds is frequent. Epistaxis, vesical irritability, sphincter atony, and incontinence may occur.

The diagnosis is made from the most manifest symptoms of pallor, muscular weakness, and dyspnea, substantiated by a blood examination, or at least a test for hemoglobin. This latter procedure will serve also to distinguish a simple form of the disease from a progressive pernicious form. Blood analysis should be practised at intervals after the occurrence of any of the infectious fevers.

Before the most prominent symptoms are present to a marked degree, the diagnosis of simple anemia can in a few instances be made (corroborated by blood examination) from the fact that the child's sleep is restless and that during the day mental torpidity is present to a greater or less degree.

PERNICIOUS ANEMIA

The pernicious form of anemia is not as rare as is commonly supposed. The apparent rarity is due to the fact that the number of cases reported is proportionately small, but when we come to consider the infrequency with which blood examinations are made in the anemias, we at once see that the proposition is not fairly stated.

Pernicious anemia must be differentiated from all other forms by an examination of the blood, and such a distinction is very important, because, in contradistinction to the mode of regeneration in simple anemia, in the pernicious type blood regeneration takes place in a way which is different from the physiologic. In the blood-forming organs (that is, those in which this function is the paramount one) and in the circulating blood we find cells which are never found in the healthy child. As these are found physiologically in embryonic life, this is termed "reversion of blood formation to the embryonal type."

Every known condition which lowers the vitality of the child may be reasonably assigned as a cause of pernicious anemia, so that there is no need of entering into a detailed account of these.

The symptoms are those of a general anemia. The pallor of the skin in this type is somewhat peculiar and yet very difficult of description. It is somewhat of a lemon yellow or a faded yellow hue rather than a waxy color, and associated with it there is more or less edema in the face, abdomen, and legs.

There is a very marked difference between the constitutional symptoms and the finely nourished appearance of the child. We encounter no disease in childhood in which such a marked cachexia exists with so little change in the adipose tissue. The whole musculature, however, is atonic. During the whole course of the disease there is a transitory fever which persists for a short time only, so that it may go undiscovered unless the temperature is taken several times daily.

Cardiac disturbances are apt to be most pronounced, and chiefly of palpation upon the slightest exertion, and this, in turn, may result in dyspnea and precordial distress. Heart auscultation shows over all of the valves (usually) clear, soft (usually systolic) murmurs. Percussion over the heart is normal. The pulse depends upon the condition of the heart, and is usually of low tension, frequent, and small.

The digestive organs exhibit a variety of symptoms, but usually there are more or less vomiting and flatulence and a marked repugnance to food, and especially to certain articles of diet. Outside of tiring quickly under the influence of exertion of the mental faculties, there are no characteristic symptoms referable to the nervous system, except one which may be prominent in older children—loss of memory. Retinal hemorrhages occasionally occur, but as they do also in simple anemia at times, there is no distinct value in finding them. They are rather an indication of the severity than of the form.

Now a word as to paresthesia, ataxic symptoms, muscular incoordinations, atrophies, and pupillary rigidity; these are considered by many writers as part of the symptom-complex of the disease, but it is too early to so consider them. They are far from being constant, are independent of the severity, and seem to be an independent affection of the cord from toxins.

Pernicious anemia runs a chronic course with remissions (of a few weeks) and covers a period of from three months to four years.

Death generally occurs during the first year. The diagnosis is made by the blood-findings. In a fairly defined case staining shows that a majority of the erythrocytes have enlarged diameters and great richness in hemoglobin. Under repeated examinations megaloblasts are found, but in small numbers. Besides these we observe normoblasts and microblasts, also microcytes. In addition, all other peculiarities of a simple anemia may be found. The red corpuscles are always reduced markedly in number; specific gravity is lessened and the hemoglobin is reduced, but with a relatively high percentage.

If the case is well developed, the diagnosis between the simple and pernicious types is not very difficult. The peculiar pallor, weakness, which is extreme, and yet with a well-developed adipose tissue deposit, the prominent heart signs, and the liability to digestive disorders, all give a picture which is most indicative of the pernicious type. After some observation, if a remission occurs, we have added a valuable differential sign.

But whether the symptoms are well developed or not, a blood examination must be made, and if in the blood there are found undoubted megaloblasts and megalocytes predominating, the diagnosis is fully established. If they are not found, the diagnosis becomes much more difficult, and repeated examinations may have to be made.

LEUKEMIA

In this disease the numerical ratio between the red and the white cells is changed and, besides this, both show morphologic changes.

The disease is very rare, may be congenital, or may begin at any time of life. The etiologic factors are not well marked.

Usually there is an insidious onset, and generally when symptoms are presented with any prominence they are the terminal ones.

Hemorrhage, which may be either slight or abundant, from the nose, mouth, stomach, or the bowels, may be the first symptom to attract attention; then, with patient inquiry, we may obtain a history of some long-standing but indefinite indisposition which preceded it. A rise of temperature is not uncommon (101° to 103° F.), and is preceded by vomiting or a convulsion. Anorexia

is marked and diarrhea may be present. And so the list might be added to almost indefinitely; there is little that is characteristic.

Among the more constant features we observe: (*a*) An abnormal amount of uric acid in the urine. (*b*) A tendency to bleeding from the mucous membranes and beneath the skin.

The course of the disease is somewhat acute, with rapid emaciation, prostration, and progressive intensification of all of the symptoms. With a less acute course death occurs from asthenia. The diagnosis rests entirely upon the findings in the blood: (*a*) Decreased red corpuscles; (*b*) increase in the number of leukocytes; (*c*) the presence of large multinuclear leukocytes, increased transitory cells, nucleated red blood-corpuscles, microcytosis, and poikilocytosis.

CHLOROSIS

This disease develops almost exclusively in young girls at the period of puberty. This practically removes such cases from the hands of the pediatrist, so that its consideration will be brief. The cause is not well understood. The blood-findings are lowered specific gravity, diminished erythrocytes, disproportionately diminished hemoglobin, with the added feature of poikilocytosis and normoblasts in the severe cases. The symptoms are due principally to circulatory disturbances. The whole musculature exhibits the want of oxygen and the atony is marked. If the diagnosis is based upon the whole clinical picture and the blood-findings, the chance of error is practically *nil*.

EXAMINATION OF THE HEART

The symptoms of disease affecting the heart are dependent upon its anatomic structure, its physiologic functions, and also upon the morbid process which may be present. The size of the organ in proportion to the body is somewhat larger in infancy. From birth until the third year the increase in the weight of the organ is rapid; from the third until the seventh years the growth seems to be considerably less, and from the seventh to the eleventh years the change is scarcely noticeable. About the time of puberty there is a very rapid increase again.

The difficulties which are offered by an examination of the heart in infants and young children are those of deduction and not those of method. There are present physiologic deviations from what we find in the adult heart, but these are pronounced and are easily remembered. The chief difficulty is in properly apportioning the value of each symptom in the young child. Under the age of two years the systolic murmur exceeds in strength to a considerable degree that of the diastolic, and while this holds true over the whole of the cardiac region, it is particularly marked at the apex.

The second sound of the heart is loudest in the left second intercostal space and is weakest in the region of the aorta.

Position of the Apex-beat.—All that can be said about the position of the apex-beat in children must be of a somewhat general nature, for if one has taken the trouble to examine a large number of hearts, the fact is soon demonstrated that the position of the apex-beat is far from being a constant feature, differing not alone in different children, but in the same child at various periods. Further than this, this change follows no definite rule. When the examination is made, the child should be in the sitting position and slightly bent forward. Generally speaking, the apex-beat is then found to be a little higher than in later life, the whole heart being somewhat higher in the chest, owing to the more elevated position which the diaphragm occupies at this period.

The apex-beat is observed to be more to the left than in the adult, but if such a deviation exceeds one inch in a child whose chest is normal in size and shape, then such may be safely considered as abnormal. In the presence of deformity of the chest or any disease or condition which alters its normal proportions, the apex-beat is changed in its relative position to the anterior thoracic wall. Less frequently in children than in adults a distention of the abdomen will alter the position of the apex-beat.

Fig. 84.—Showing the marked change in the position of the apex-beat by change of posture. The solid dot indicates the position of the apex-beat when the child is recumbent. The circle indicates its position when the child is lying upon the left side. The figures 4, 5, and 6 correspond to the ribs.

Displacements of the Apex-beat.—In cardiac hypertrophy, and especially that of the left ventriele, there is a moderate degree of displacement of the apex-beat to the left. If the displacement is of a moderate degree to the right, it is suggestive of hypertrophy which affects the right ventricle mostly. When the displacement is more than moderate in degree and is very noticeable, then the indications are different, and the cause is usually found to be some condition outside of the heart, and particularly of pleuritic effusion.

Inspection.—For the purposes of diagnosis inspection is frequently made of the precordia, which is the portion of the chest which immediately overlies the heart. The child must be stripped and placed in a good light if any information is to be gained.

Prominence of the precordia is observed sometimes in hypertrophy of the heart, but is much more frequently seen in children who are rachitic or who have been subjects of that condition within a year or so. This must not be confounded with that prominence of the chest which is more general and which persists for

life and is due to rachitis. When the precordia is sunken or depressed, the cause is in almost every instance an old rachitis.

Palpation.—This is the method by which the apex-beat is located, for inspection is very unsatisfactory in childhood, and in infants the cardiac impulse is so weak and the infant chest so well covered with tissue that inspection is practically valueless in locating the beat. The whole hand should be gently but firmly pressed over the precordia, then the finger may be placed at the point where the greatest impulse has been felt, and the apex-beat is distinguished as a distinct thrust against the finger. The best position is the sitting one with a slight inclination forward, and in some instances a change of position will supply more information.

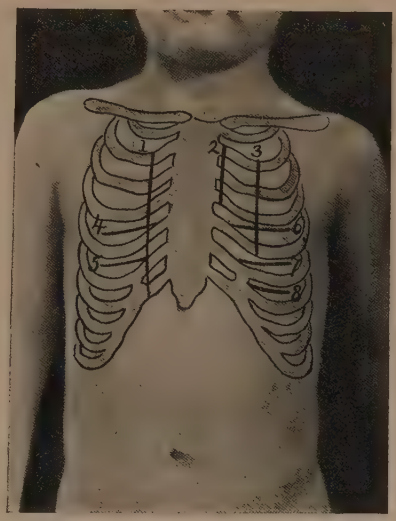

Fig. 85.—Lines of cardiac percussion. In the percussion of a child's heart it is well to follow some system, and the above diagram illustrates one method. The lines of percussion are numbered in the order in which percussion should be carried out.

Percussion.—This must be very lightly performed or the result will prove of little value, for the chest wall is thin and very elastic in children. Now the chief difference in the results of percussion in children is that the area of relative cardiac dullness is proportionately larger in them than in adults.

The younger the child, the more wide-spread is this dull area, and if its normal limits are not remembered, it would readily lead one into the error of supposing that there was a degree of hypertrophy present. The area of absolute cardiac dullness is also relatively larger in the child than in the adult, although the shape of the area is about the same. A reference to the accompanying charts (Figs. 86, 87, 88) will show the extent of these areas better than a detailed description could.

At the age of one year the upper limit of the relative cardiac

dullness is the cartilage of the second rib; at six years this has lowered its level to the second intercostal space, and at twelve years the limit is at the cartilage of the third rib. The margin at the right at one year is the right parasternal line (on a level with the nipple); at six years it is slightly more to the left, and at twelve years it is about midway between the parasternal line and the right border of the sternum. At one year, at six years, and at twelve years the left border of dullness is slightly beyond the apex-beat.

The area of absolute dullness during the first twelve months is limited to the lower border of the third rib, and at six years there is a diminution, so that the area extends to the upper border of the fourth rib only, while at twelve years its limit is the lower border of the fourth rib. The right margin of absolute dullness is constant at all ages and is the left border of the sternum. The left border of dullness never quite reaches the mammillary line.

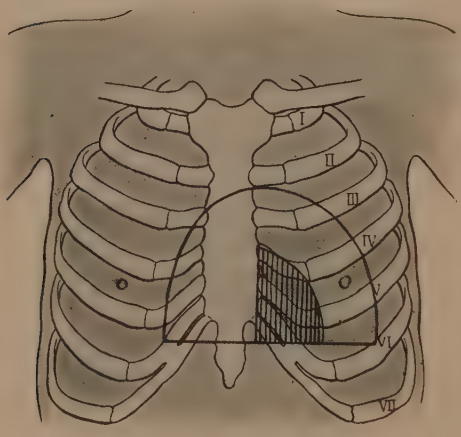

Fig. 86.—Relative cardiac dullness (outlined) and absolute cardiac dullness (shaded) areas in a child of six years.

Auscultation is of no practical value unless one succeeds in having the child remain quiet during the examination. On account of the thinness of the walls of the child's chest, all sounds are proportionately louder than they are in the adult, and as a natural consequence the area of diffusion is much greater. Just as in examining the chest, one is never certain of the exact spot examined when the unaided ear is used, an examination of the heart is never accurate without the use of the stethoscope.

During the period of early infancy, at least, the differentiation of diastolic and presystolic murmurs is well-nigh impossible, on account of the normal rapidity of the heart's action at that time

of life. The rhythm and the frequency of the heart's action are both so easily disturbed in infancy that their significance is much less than in adults.

Under conditions which are normal, the second sound of the heart is the weakest (at the aortic orifice); the loudest is the first sound at the apex. The accentuation is upon the first sound and not upon the second, as we observed in adult life. Reduplication of the sounds of the heart is not infrequent, and it is due to the fact that the valves of both sides do not close at exactly the same moment. It is most marked under the influence of excitement.

When a murmur is present, the question at once arises, "Is it

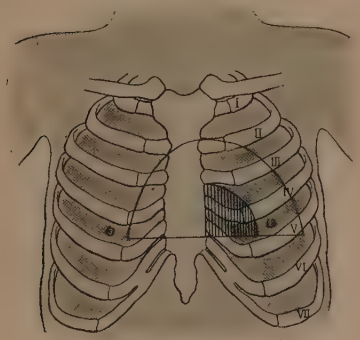

Fig. 87.—Infant of one year of age.

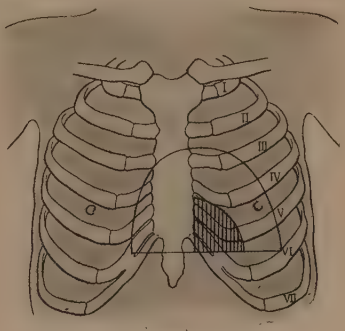

Fig. 88.—Child of twelve years of age.

The areas of relative cardiac dullness (outlined) and of absolute cardiac dullness (shaded) in an infant of one year and a child of twelve years.

from the heart, from the pericardium, or from the great vessels?" During the first three years of life systolic murmurs predominate to a very large degree; accidental murmurs are not common.

If there exists a diffused dull sound of the heart and this is associated with an increase in the apex-beat, hypertrophy should be suspected. If, however, the apex-beat is materially weakened, then one of two conditions may cause it—fluid in the pericardial sac or dilatation of the heart.

The former condition is rare in young children, is accompanied by more or less painfulness upon pressure over the precordia, and is associated with a friction rub. If hypertrophy exists and the sounds of the heart remain apparently unaltered, it is strongly

suggestive of chronic nephritis, and the urine should be examined at once.

Pericardial Murmur.—This is more of a cracking than a blowing sound and is heard over a limited area only. The friction rub may or may not be increased by change of position from the prone to the upright, but it usually is increased. Friction rub appears generally at the base and its occurrence is not connected with either systole or diastole.

Acute Pericarditis.—This disease is rarely encountered before the third year of life, although after that time it is observed frequently in association with rheumatism, being one of the common fatal complications of that disease. Next in frequency it is secondary to pleurisy or to pleuropneumonia, the acute infectious diseases (particularly scarlet fever), pyemia, tuberculosis, and local conditions (as traumatism, abscess, necrosis of neighboring structures, etc.).

In early infancy left-sided lesions of the lungs are the most common causes, while pyemia holds second place. From six months until the third year the most frequent etiologic factors are bone disease and traumatism. During the third year tuberculosis looms up into prominence, and after that rheumatism is the great factor, with the acute infectious diseases second. It is important that these factors be remembered, for it leads one to an early diagnosis, which is of prime import.

The results of a pericardial inflammation may be the production of serum, fibrin, pus, or blood, and these vary in different cases and, in fact, in different stages of the same attack. The effusion may be large or only slight.

Before the seventh year the symptoms are anything but distinctive, and it is only by careful examination of the heart after the occurrence of one of the diseases which pericarditis usually follows that the diagnosis is made. There may be dyspnea, cyanosis, restlessness, or a slight temperature rise to arouse one's suspicion of the onset of the disease, and, upon the other hand, all of these may be entirely absent.

Following a pneumonia or pleurisy, the only thing to lead one to suspect the disease may be a prolongation of the original disease, and then examination reveals that this depends upon the condition

of the heart. If the disease is of the purulent form, then there are symptoms of septicemia, an irregular temperature, chills, profuse perspiration, and rapid and extreme prostration or collapse.

In older children (that is, about seven years of age and over) the symptoms are more definite and the physical signs resemble quite closely the adult type. These include a double friction rub which appears early in the disease and lasts for a short time only (so that it is commonly overlooked). This is heard over a small area near the base, the sound is not transmitted, and there is no relation of the sound to respiratory movement. When effusion has occurred, then the position of the apex-beat is altered, it usually being displaced upward. In any event, it is more indistinct and may not be noticeable at all.

Fig. 89.—Point at which pericardial friction is most often heard.

There may be some bulging of the chest wall and an early edema is suggestive of purulent effusion. The normal area of cardiac dullness is increased in all directions. As effusion is absorbed, the friction rub may return. An attack usually persists for two or three weeks, and may be followed by a subacute or chronic form of the disease.

The difficulties of diagnosis are threefold in infancy: there is the rapid action of the heart, the remarkable compensatory powers, and the non-distinctive character of the symptoms. The acute dry form is so rare under the age of three that a diagnosis of that form must be made with great reserve. After the child has passed the age of three years, the diagnosis of pericarditis in the acute form is made by practically the same signs as in the adult, but the early recognition of the disease comes by a remembrance of the etiologic factors and a consequent frequent examination of the heart.

The diagnosis of pericardial effusion offers much difficulty because of the similarity of dilatation. Dilatation is distinguished mostly by the pulsations of the heart being visible in wave-like undulations and the fact that it is a comparatively rare condition except under the influence of advanced valvular disease.

From pleuritic effusions the distinction may be impossible, but the points to determine which help to favor the diagnosis of this condition are that the heart is displaced somewhat to the right while there is an uninterrupted dullness to the left; the heart sounds are not very feeble.

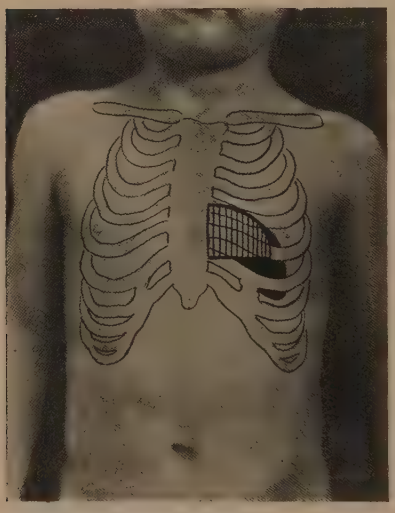

Fig. 90.—Hypertrophy of the left ventricle. Area of dullness in solid black. Normal area of absolute cardiac dullness lined. Apex is carried to the left and downward.

Chronic Pericarditis.—This is more frequent than was formerly supposed and yet is not common in childhood. It is found frequently at autopsy when no pericardial inflammation was suspected during life. It may follow successive acute attacks or the disease may be chronic from the start. This is the disease which, above all others, is treated as a functional heart trouble, for in most instances the symptoms can all be explained upon that basis, if one is satisfied with the belief that functional heart disturbances are not the evidences of some disease which we are not capable of diagnosing at the present time and with present methods.

When distinct signs are obtainable, there is usually a permanent extension of cardiac dullness, obscured heart sounds, and during systole a contraction of the chest over a small area close to the apex. This is followed by a diastolic impact or rebound which is best observed by palpation. A similar contraction may sometimes be seen in the infrascapular region in the tenth interspace on the left side (Broadbent's sign) and at times on the right side. The heart

is enlarged, and because of this and the presence of murmurs valvular disease is suspected.

Acute Endocarditis.—This disease is very rare before the third year of life, but after the fifth year is not so uncommon. With our present knowledge it may be safely accepted that the disease is always secondary to some infectious organism. Two-thirds or even more of all of the cases are secondary to rheumatism, and in a large proportion of these the disease of the heart may be the only indication of the rheumatic condition. It is not uncommon to observe chorea preceding or associated with endocarditis, and this may be without any evidence of articular symptoms. In a small proportion of instances the disease is secondary to one of the acute infectious diseases (particularly scarlet fever) or follows pneumonia or pleurisy. In a smaller number of cases it is secondary to bone disease, typhoid fever, and diphtheria.

The onset of the disease, when it occurs as a manifestation of rheumatism, or independently of acute disorders, is rather abrupt, with severe general symptoms, as malaise, high temperature (103° to 105° F.), marked prostration, restlessness (or stupor), exaggerated heart action, and sometimes dyspnea and cyanosis. Usually the disease is not recognized even by these symptoms, but the case is diagnosed as one of tonsillitis, pharyngitis, acute indigestion, or some similar disease.

An examination of the heart at frequent intervals would, of course, eliminate such errors. It is not until about the third or fourth day after the onset that one is able to obtain positive information which is sufficient for a diagnosis of endocarditis, and then there is obtained the characteristic soft, blowing, systolic murmur at the apex (see later).

The usual duration is from two to seven days for the severe general symptoms, and for the whole attack from one week to three weeks. Then there may be a gradual subsidence of all symptoms (rare), the persistence of a murmur with subsequent typical signs of valvular disease (the usual course), subsequent dilatation of the heart, or repeated attacks.

The diagnosis is frequently not made, and this is not because of much difficulty, but because the disease is not looked for and the heart is not examined. It is of the utmost importance that the

heart be examined and reëxamined under conditions in which there is the slightest ground for suspicion of rheumatism, and this is regardless of the fact of articular symptoms.

Soft, Blowing, Systolic Murmur at the Apex.—This is generally the first sign which we have of the existence of an acute endocarditis. There is usually a transmission of the sound to the left, and later there are observed the evidences of dilatation or cardiac insufficiency. These positive signs are usually preceded by suspicious ones, as exaggerated heart action, restlessness, and fever, occurring during the course of a rheumatic condition in the child, or more often occurring as the only manifestation of rheumatism.

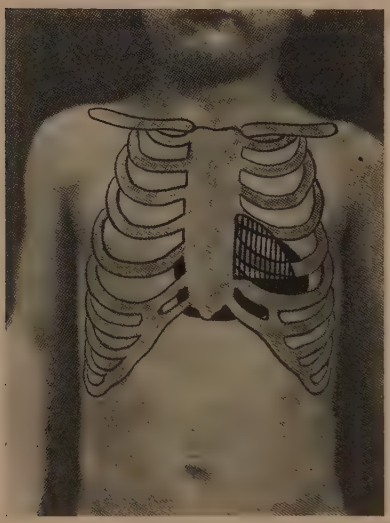

Fig. 91.—Hypertrophy and dilatation of the right heart. Area of dullness in solid black. Area of normal absolute dullness lined. Apex is carried to the left, and note that dullness extends to the right of the sternum.

From endocarditis there must be a distinction made from pericarditis, and this is usually simple, for in the former the soft, blowing, single murmur at the apex is quite characteristic. It is diminished by full inspiration also.

Malignant Endocarditis.—This is rare in childhood and the symptoms are not suggestive and occur in such variety that the diagnosis is generally extremely difficult. The only symptoms which are at all indicative of the possibility of malignant endocarditis being their cause are the development of pyemic or typhoid symptoms with a petechial eruption in a child whose previous history is not suggestive of anything, but who has previously been a victim of valvular disease. The abrupt onset distinguishes it from typhoid in most cases very early.

Chronic Valvular Disease.—The symptoms usually come on very insidiously, and, like most of the diseases of the heart in childhood, the discovery of the condition is accidental. This can only

be so because we are neglectful in our examinations (or, rather, we do not make them) of the heart in children until some symptom definitely points to the heart as the cause of it. Instead of this, one who deals at all with the diseases of children should be constantly mindful of what etiologic factors are present and thus an earlier diagnosis would be made. There are naturally two rather well-marked divisions which are observed in chronic heart disease

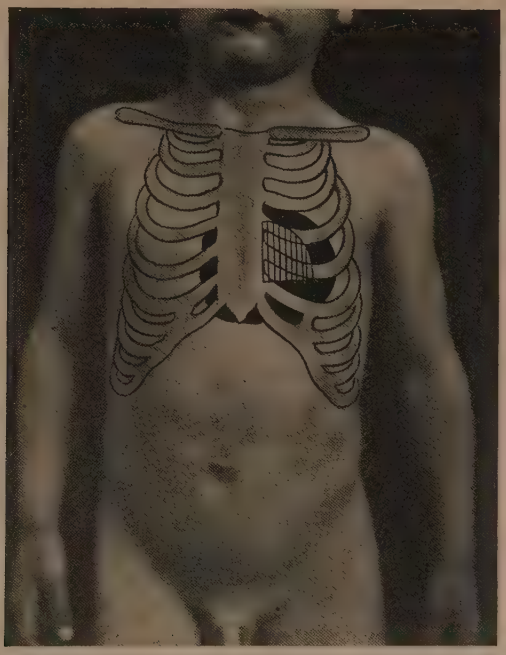

Fig. 92.—Hypertrophy and dilatation of both ventricles. Area of dullness in solid black. Normal area of absolute cardiac dullness lined.

of the valves—the time when compensation is good and the time when it is poor or absent.

Of the first stage (compensation good), only subjective symptoms are noticeable, and the chief of these is shortness of breath upon exertion or excitement. Cough, epistaxis, palpitation, lip pallor, and headache are much less constant symptoms.

The second stage (compensation poor or absent) usually follows some condition or disease which throws additional work upon the

heart suddenly or for a protracted period, and among such factors are acute illnesses, puberty, unusual exertion, malnutrition, etc. The symptoms of this second stage are those of weakened heart action, with the veins overfilled and arteries underfilled. As might be expected, dropsy, beginning in the dependent parts (feet), is a usual accompaniment. Then follows a long train of symptoms: enlarged liver, enlarged spleen, dyspeptic symptoms of great variety, scanty and albuminous urine, dilatation of the superficial veins, clubbing of the fingers or toes, various cerebral symptoms, etc.

Of the various clinical varieties, mention is made in detail, following.

Mitral Insufficiency.—This is generally due to attacks of acute endocarditis and is the commonest form of valvular disease in early life. There is systolic murmur, synchronous with the impulse of the apex and with the first sound of the heart, but it may also in part replace the second sound. It is heard with most intensity at the apex and is transmitted to the left. It may also be heard at the inferior angle of the left scapula. The murmur is very diffused.

With only the foregoing data at hand, one is not sure that the murmur is not a so-called functional one, but in mitral insufficiency there is an accentuation of the pulmonic (second) sound heard at the left border of the sternum in the second space, and there are also signs of hypertrophy. If the last two are absent, then the diagnosis of mitral insufficiency must be guarded. Along with hypertrophy there is a carrying of the apex-beat downward and toward the left, and there may be some bulging of the chest wall. The heart sounds are loud and somewhat metallic. If dilatation is present, then the heart sounds are enfeebled and murmurs may even be lost entirely. The apex-beat is more readily made out and the area of cardiac dullness is increased.

Mitral Stenosis.—There is a somewhat prolonged presystolic murmur, which is rough in its character, and terminating sharply with the first sound of the heart. It is loudest at the apex and is soon lost at a short distance from that point. There is a purring thrill which may be obtained by palpation, and which terminates suddenly as the impulse of the apex-beat is felt

again at the chest wall, and such a thrill is equally valuable in diagnosis.

Aortic Stenosis.—This gives a systolic murmur which is heard with greatest intensity at the right border of the sternum in the second space, and is from there transmitted upward distinctly to the carotids. The second heart sound is weak. There is an associated hypertrophy of the left ventricle, and if this is not present, then no positive diagnosis can be made from what we call a functional murmur.

Aortic Insufficiency.—This is very rare in children. There is a prolonged diastolic murmur coincident with or substituting the second sound. It is loudest at the left border of the sternum in the second space, and is transmitted downward to the apex. Associated with it there are marked heart hypertrophy and some dilatation (left ventricle), the hypertrophy being very noticeable during the time of good compensation, and the dilatation being most pronounced when compensation has failed. If there is an intense throbbing of the carotids with sudden distention and then subsequent collapse of their walls, it is characteristic of aortic insufficiency.

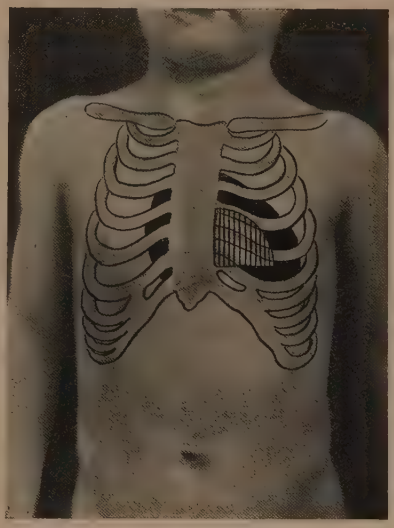

Fig. 93.—Large pericardial effusion. Area of dullness in solid black. Normal area of absolute cardiac dullness lined.

Tricuspid Insufficiency.—Systolic murmur is heard with greatest intensity over the lower portion of the sternum, and then over a limited and small area only. There is an associated dilatation of the right ventricle, the jugular veins are prominent, and there may be at times a decided systolic pulsation in them.

Tricuspid stenosis, pulmonic stenosis, and **pulmonic insufficiency** are practically foreign to childhood (except as part of congenital disease).

Functional Murmurs.—I deplore the necessity which compels

us to use the term functional, and am strongly of the belief that functional murmurs do not exist in fact. The capacity of the child to compensate is so large that a considerable amount of disease may be present without more than the slightest symptoms. With our present knowledge and methods we are compelled to continue the use of the term. In the recognition of such murmurs there must be repeated examinations of the heart and the elimination of any detectable change in the structure of the heart, and when this is determined, then there must be found an adequate cause for disturbance of the heart's action.

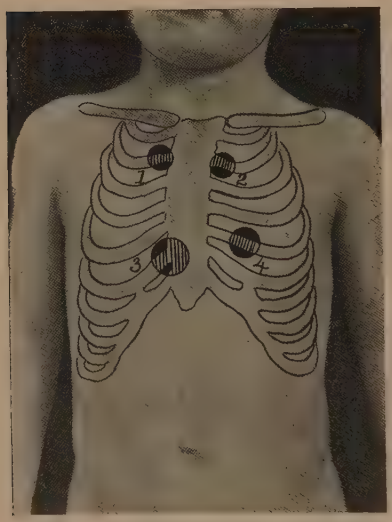

Fig. 94.—The diagnostic import of the location of friction fremitus. 1. Systolic aortic stenosis; diastolic: aortic insufficiency. 2. Systolic: pulmonary stenosis; diastolic: pulmonary regurgitation. 3. Systolic: tricuspid insufficiency; hypertrophy and right ventricle dilatation. 4. Systolic: mitral insufficiency, aortic stenosis, myocarditis. Presystolic: mitral stenosis; aortic incompetency.

Functional Heart Disease (or Disorder).—The same must be said of this as was said in regard to the existence of functional murmurs; similar methods must also be followed in diagnosis (exclusion of all possibility of recognizable organic disease and the finding of an active cause). Such disturbances are unusual before the age of seven. The usual manifestations are palpitation, tachycardia, bradycardia, and dizziness. The first and last mentioned are the most frequent. The attacks come on in paroxysms and last from a few minutes to a few hours.

Venous Murmurs.—These are heard in the neck alone in some instances in which the child is in perfect health, and the limit of the area is the posterior border of the sternocleidomastoid, close to its clavicular attachment. If these murmurs are heard in any other situation, then they are strong presumptive evidence of anemia (see "Anemic Murmurs").

Anemic Murmurs.—These murmurs differ from the organic ones mainly in the fact that with them there are associated no other symptoms of heart disorder or disturbance. The murmurs are heard mostly at the base of the heart, on the left side, in the second space, or on the sternum itself, and are never loud. They are coincident with the systole invariably. Another characteristic is that they change from day to day, and this quality is even noticeable to a considerable degree at times under the influence of changed position. Sometimes they disappear entirely for a period.

A very marked venous murmur may occur in anemic children and be heard below the clavicles on both sides of the chest, and as it increases under conditions which accelerate the flow of blood in the neck, it may be mistaken for an organic murmur. When repeated examinations can be made, the inconstancy of such a murmur is soon evidenced, but when the diagnosis is desirable at once, the influence of change in the position of the head upon the murmur may be studied. In the venous murmur there is increase when the head is turned toward the side and decrease when the head is straight.

Associated with anemic murmurs there is the general condition which causes them and its train of symptoms.

Congenital Heart Disease.—This is in most instances due to malformation of the heart or to an anomalous disposition of the vessels. The defect or the combination of defects which may exist will not always show itself at birth or immediately afterward. Sometimes it is noticeable at once and is very evident, and, upon the other hand, there may be no suspicion of the trouble for one or even several months after birth. A much less number escape notice for a year or more, and more rarely still the period of puberty may be the time when the condition is first noted.

Persistent cyanosis is in nearly every instance due to congenital heart disease, but its importance as a diagnostic sign to be looked for is very much overestimated. If cyanosis is persistent, it is a valuable indicator, but its absence proves nothing in regard to congenital heart disease. When present, cyanosis is more evident under the influence of such acts as crying, coughing, or, in fact, of any unusual exertion. It is much more constant in congenital heart than in the acquired forms of disease.

Murmurs are usually present, the most characteristic being a systolic murmur, which is most intense at the left base and very diffused. The kinds of murmur present are not of considerable diagnostic import; the real value comes in their being loud. Loud diffused murmurs which are associated with cyanosis are almost invariably due to congenital heart disease, while loud apex murmurs are indicative of the acquired forms.

In congenital heart disease there is generally more or less en-

Fig. 95.—Auscultation of the vessels of the neck.

largement present (evidenced by dullness extending to the right of the sternum, with displaced apex-beat to the right), and there may be bulging over the precordia or at the lower end of the sternum. It is not always easy to decide that the case is one of congenital disease, for anemia offers some similarity at times. However, if the murmur exists alone and the child is anemic, the evidence is strong against congenital heart. As a result of congen-

ital heart the child is generally stunted in its growth and development, many of such children remaining rather puny and weak.

For practical purposes it is not necessary to distinguish between the different types of lesions which are present. In most instances it is impossible to do so anyway, because of the prevalence of many lesions in one case, and the rapidity of the heart's action does not allow of a proper appreciation of the different sounds and conditions present.

THE PULSE

The pulse, like the respiration in childhood, is very variable, the slightest cause being at times sufficient to disturb both its frequency and rhythm. Whenever possible, the pulse should be taken during sleep, and for this it is not necessary to disturb the infant for if the wrist is not accessible, by a little practice one can just as readily gain whatever information is possible by placing the fingers upon the temples.

When the frequency is great, then every second beat may be counted for a full minute and the result multiplied by two.

Rate.—Shortly after birth the rate may vary from 120 to 140 a minute, but this is subject to considerable variation. During the first six months of life the average rate is 130; during the second six months, 110; during the second year, 100; from the third until the fifth year, 90; and from the fifth to the fourteenth year, 80.

Increased Frequency.—Under certain conditions the cause of tachycardia is clear, as when it is due to drug action. Fever also increases the heart action, as the increased body-temperature stimulates the central endings of the accelerator nerves and the heart muscle itself. Uninfluenced by any other disturbing factor, the frequency of the pulse is proportionate to the increase in the temperature. This ratio, however, is disturbed in some diseases and is usually due to the action of toxins.

In childhood increased frequency is in most instances due to the presence of fever or of prolonged crying. Either one of these causes may increase the rate in an infant from 40 to 60 a minute. Then there are several minor factors which do not act so decidedly: the time of the day (the rate is highest in the evening), the season of the year (the pulse is more rapid in warm weather), exercise or play, the upright position, mental excitement, and pain.

Much more important than any of these is the accelerative influence of convalescence, general debility, anemia, and hemorrhage upon the rate of the pulse. Increased frequency accompanies all

of the valvular diseases of the heart. A frequent but feeble pulse indicates weakness of the heart's action, and if it occurs associated with coldness of the extremities and any cyanosis, these may be the only signs which we may have for a time in impending heart failure.

It is just this character of a pulse which should be watched for, for weeks after an attack of diphtheria, because it will give us warning of threatened heart failure sometimes for days, and I believe always for hours, before the event actually occurs. In scarlet fever the pulse-rate is characteristically rapid—more so than in any other disease with a similar elevation of temperature.

Decreased Frequency.—This may be directly due to the use of certain drugs, especially opium, which is such a decided poison to infants and young children. Certain toxins circulating in the blood may produce a bradycardia. The pulse is relatively slow in typhoid fever. When the pulse is retarded and at the same time irregular, it is very suggestive of cerebral disease. In infancy this retardation may not be absolute; that is, we may observe a rise in the temperature which is not associated with a corresponding rise in the pulse-rate, although it is still irregular.

Irregular.—The knowledge of the disturbances of rhythm is very limited, and the pulse is not an absolute guide to the heart's rhythm. A weak contraction of the heart may not give rise to an arterial pulse, and then again waves of different sizes may be sent at different speeds toward the periphery, so that the pulse cannot correctly interpret the rhythm.

A slow, irregular pulse is always significant in childhood and should at once suggest the possibility of meningitis. On the other hand, a rapid and irregular pulse has no diagnostic value. Speaking generally, irregularity of the pulse in early childhood is of no moment unless associated with other qualities. It occurs under so many conditions, even being the rule in health, that the value of finding it is practically *nil*.

URINATION

Dysuria.—Painful urination is very closely associated with retention of urine, and in some particulars it is quite impossible to clinically separate the two. When there is painful urination in a child, then there is more or less forced retention, and, on the other hand, when there is retention, pain is usually, although not always, present.

Dysuria almost always points to some local condition, and the most frequent of these is as follows:

In the newly born there is commonly noticed a sandy excretion upon the diaper after the act of urination, and the act is associated with evidences of considerable pain. This persists with every act of urination for a week or two; rarely longer than that.

In the newly born also another frequent cause is a prepuce which is adherent to itself or to the glans penis. The recognition of this condition is at once made upon examination. Sometimes when the attempt is made to draw back the foreskin, such resistance is met with that even the orifice of the urethra cannot be exposed. There are two active factors in this cause of dysuria—the mechanical obstruction itself and a reflex spasm of the sphincter of the bladder caused by the irritation of the retained smegma around the glans. In females the adherence of the labia will result in similar symptoms. More infrequently there are congenital defects of development, and particularly of the urethral mucosa.

Pain of a burning character may be due to a too concentrated urine or overacidity of the same. The pain and distress which such a condition will cause in a child of a strongly neurotic temperament seem to be out of all proportion to the cause. The diagnosis is quickly confirmed by an appropriate line of treatment. In case the treatment fails, then it is strong evidence that we are dealing with neuralgia of the pudendal nerves. The most intense of all dysurias are those which are due to vesical calculi. The stream

of urine is apt to be suddenly and repeatedly interrupted in its flow, and blood may be present in the urine.

We will now consider some of the more frequent causes of dysuria in detail.

Calculi.—The stones which occur during childhood are composed mostly of urates and uric acid (amorphous and crystalline), but there may be an admixture with the triple phosphates and other salts. Calculi may be formed in the kidney, and when not too large, may be passed on down into the bladder. They may be single or multiple, irregularly shaped or rounded. Renal calculi are much more common during childhood than during adult life, and vesical calculi are about eighteen times as frequent in males as in females. That there is a hereditary tendency to the formation of stones has been clearly demonstrated.

There are many symptoms which are highly suggestive of calculi, and these are: frequent urination, whether during the day or at night, sudden diminution or stoppage of the stream of urine during the act of urination, pain or discomfort in the region of the bladder, especially under the influence of exercise, and straining during urination. Such symptoms, however, are merely suggestive, for they may be present in similar variety and degree in many other conditions. When these other conditions are reasonably eliminated, then the only means for a positive diagnosis is examination with the sound.

When a stone is being passed through the ureter, there is generally marked paroxysmal pain which begins in the lumbar region and radiates toward the pubis. The testicle upon the corresponding side may be retracted. When the passage is accomplished, pain usually suddenly ceases.

Instead of these symptoms one may observe that there is dull, persistent pain in the loins, radiating to various parts of the lower abdomen and thighs, and especially noticeable after exercise. Associated with these there are usually more or less disturbance in the quantity of urine voided (generally an alternating scantiness and excess) and some nausea or perhaps vomiting. These are collectively strongly indicative of calculi in the pelvis of the kidney. When the stone is situated in the kidney, blood may be present in

the urine in considerable amounts; but when in the bladder, hematuria is rare.

The diagnosis must consider the possibility of the symptoms being due to cystitis. Bimanual examination will detect a stone of considerable size when it is in the bladder, but a negative result does not exclude calculi. Exploration by the sound gives the only positive means of diagnosis.

Balanitis.—It is easy to see how an inflammation of the prepuce which causes that part to become swollen, edematous, red, and sometimes covered with pus would result in dysuria. And this is the situation in balanitis. Retraction of the foreskin is not possible, and usually during the act of urination it balloons considerably.

While no examination can be made of the parts on account of the tightness of the prepuce, the disease is evidenced by marginal redness with the appearance of pus at the opening. In this connection it is very important to determine that the pus is not from the opening of the urethra, for in this latter case we are dealing with an entirely distinct condition. To determine this, and also for the application of proper treatment, it may be necessary to slit up the dorsum of the prepuce, so that the parts may be exposed.

Urethritis.—This may be simple or specific; it is very important to determine which.

The simple form is benign, and no matter how protracted its course, does not exhibit any sequelæ. The inflammation is usually confined to the anterior portion of the urethra and the discharge of pus is slight. The pain during urination is usually not extreme.

Gonorrheal urethritis is more common than the simple form and the usual cause is direct contagion. The symptoms resemble the adult type without the marked constitutional signs. When once suspected, an examination of the discharge should be made by the microscope, for the only positive means of diagnosis is the presence of the gonococcus.

Vulvovaginitis.—This may be of simple or of specific form. The simple form may be a persistence of the normal secretion which is present at birth, but which, under the influences of malnutrition and uncleanliness, occasionally becomes purulent. It is much more common, however, after the period of infancy is past, and

occurs mostly in anemic, poorly nourished girls. Sometimes it directly follows some acute infectious disease, particularly rubeola.

Dysuria is usually the first thing complained of, and this is found to be associated with a discharge which is thin and yellowish-white in color. When the inflammation is more intense, the color may become a yellowish-green and the vulva, hymen, and vagina are intensely inflamed and somewhat swollen. There may be a fetid odor to the discharge. Sometimes it is so abundant that the parts are glued together and excoriations are common. The disease runs no definite course and there are no general symptoms.

In the gonorrheal form there are generally some slight indefinite symptoms (malaise, slight temperature rise, anorexia, fretfulness, etc.) which precede the appearance of the local signs. Dysuria is generally marked, and with its occurrence there is the presence of a copious discharge of thick yellow pus (sometimes with a greenish tinge) which leaves a characteristic stiff stain upon the clothing. Erosions readily occur, so that there may be more or less bleeding. The child may experience some difficulty in locomotion, on account of the swelling and the excoriations. The diagnosis is made by an examination of the discharge, which shows the presence of the gonococcus.

Erosions of the Prepuce and Glans; Erosions of the Labia; Herpes of the Vulva.—All of these conditions frequently cause an amount of dysuria which is not in proportion to the lesion. The suffering is sometimes extreme, and especially in nervous children. This results in enforced retention. If an erosion is situated just within the orifice of the urethra, the pain and the persistence are marked features.

FREQUENT URINATION

Many of the conditions which are associated with dysuria also result in frequent urination. One of the commonest causes of frequent urination is some abnormal condition of the urine; it may be too acid or too concentrated, or, again, it may contain some irritant substance. When the passage of a stone is taking place there is frequent and strong desire to void the urine, and the desire may continue even when the canal is occluded by the stone. Very

frequent urination, sometimes painful and sometimes not, accompanies cystitis. It is one of the constant symptoms.

Cystitis.—This disease is not uncommon in children, but is more frequent in the females. The most common cause is exposure to cold, but bacterial infection takes place readily. Any of the conditions which excite local congestion may result in the occurrence of the disease. The one constant symptom is the desire for frequent urination, and this is associated with ardor urinæ and tenesmus. There may be some temperature rise, but the local symptoms are the only marked or definite ones. The urine in the beginning of the attack is high-colored, acid, and concentrated, and may contain blood, pus, and mucus. Later the urine is generally strongly alkaline or it may be neutral, and has a noticeable ammoniacal odor. Naturally there is usually considerable sediment in such urine, so that it may appear ropy. The diagnosis is simple when the urine is examined, and this also usually reveals the cause. Cystoscopic examination is only available in older children.

Vesical Spasm.—This is evidenced by frequent urination, which is sometimes accompanied with pain. No age is exempt, but most of the cases are noticed in children between the ages of two and seven. The only symptoms are the local ones of frequent urination, perhaps some pain, passage of small quantities of urine at a time, and sometimes ardor urinæ. Blood is never present in the urine.

RETENTION OF THE URINE

Retention is distinguished from suppression (which is considered later) by the fact that the urine reaches the bladder but is there retained. When retention actually exists, the bladder is more or less distended and is usually easily palpated. Under a hasty examination such a condition may be mistaken for ascites, but with reasonable care this could not occur, for a well-defined tumor is mapped out, corresponding to the situation of a distended bladder. The tumor disappears completely by catheterization.

It is a very easy matter to overlook the existence of a distended bladder, and especially during the course of typhoid fever and meningitis, and in these diseases particularly it should be watched

for. Some children get into the bad habit of holding the urine as long as possible so as not to interfere with their play, and when the act is then undertaken, the atonic condition of the distended bladder causes a temporary retention.

Fear of pain caused by the act of urination is a very common cause of retention in little children, and this is the reason why retention is so closely associated with dysuria. The same causes are, of course, operable in producing not only one but two conditions. Certain injuries to the spinal cord and all states of coma result in more or less retention. Complete retention may sometimes be the result of malformation.

ANURIA (SUPPRESSION OF URINE)

Suppression of the urine is distinguished from mere retention by the fact that the urine never reaches the bladder. Total suppression in the newly born may be due to some serious organic lesion or to some malformation. The usual causes are occlusion of the ureters or the renal tubules, or an absence of the secreting structures, this coming through the influence of degenerative changes, inflammations, or from neoplastic growths.

Pressure from tumors, twisting of the ureters, or even faulty anatomic relations may cause it. Uric acid infarctions in the kidneys may induce it. Such a condition, when it clears up, gives a very acid urine at first and the urine is filled with uric acid crystals. Renal disease is the commonest cause.

The fact that anuria really exists is demonstrated by the use of the catheter, and the bladder is found to be empty.

SCANTY URINE

Scanty urine must be distinguished from suppression and retention. The condition arises frequently under the influence of any condition which diverts the fluids of the body in some other direction. So it is the common occurrence after severe vomiting from any cause, during diarrheal diseases, under the influence of fever, when the sweat-glands are especially active, and when the ingestion of fluids has been lessened. Lowered blood-pressure from

any cause predisposes to it. Many of the renal diseases induce it, especially the acute congestions, chronic congestions, acute degeneration, and acute diffuse nephritis.

INCONTINENCE OF URINE

The loss of control over the escape of the urine, or an unconscious voiding of the urine, may be due to contraction of the muscular fibers of the bladder or to relaxed or paralyzed sphincters. Such conditions may exist on account of causes within the brain; as comas (especially epileptic), insolation, shock, and the typhoid state. On the other hand, there may be simply interference with conduction to or from the vesical centers, as in injuries to the spinal cord, either from trauma, disease, or toxins.

Irrespective of these rarer causative conditions, incontinence occurs as a true neurosis in children, and is known as enuresis.

Enuresis.—Before one can properly recognize the condition there are several etiologic factors which must be understood. Age acts as one factor, as the nervous system is in early life so unstable; heredity acts by endowing the child with an irritable nervous system; chronic malnutrition occasions a malnourished state of the nerves, thereby increasing reflex irritability and decreasing inhibitory control.

With the foregoing predisposing factors operative, it only requires a slightly active cause to start trouble and to keep it going. It may be a too acid urine or a too concentrated one, an overdistended bladder, too free ingestion of fluids, phimosis, worms, vaginitis, anal fissure, and a hundred and one other things whose importance is so slight that it is scarcely worth mentioning them. I really do so simply to put an estimate upon their unimportance, for with their removal there is no clearing up of the trouble, unless they have been the cause, not of the enuresis, but of the irritable condition of the nervous system.

The only symptom is bed-wetting, and this naturally takes place with most frequency during the first two hours of sleep, when unconsciousness is most profound and inhibitory control weakest. The voiding of the urine may occur several times during the night, but this is not the usual course. By the time the age of seven is

reached, the nervous system is generally less susceptible to reflex influence, so that the child is spontaneously cured. Sometimes the incontinence is not alone at night, but is present during the daytime also, but this form of the trouble is somewhat unusual and extremely difficult to cure.

DISEASES IN WHICH DIMINISHED EXCRETION OF URINE IS MARKED

Diminished excretion of urine is one evidence of a low blood-pressure, and therefore it is expected to occur under any condition in which the heart action is weak for a considerable period.

There is marked diminution in the secretion of the urine, during the acute exacerbations which occur in chronic parenchymatous nephritis, but at all other times the amount of urine is increased.

Anuria or suppression of urine is considered separately in this part (see page 295).

A more or less marked diminution in the volume of voided urine is noticed under the following conditions:

Acute Congestion of the Kidneys.—This disease may result from exposure to cold, to traumatism, from the ingestion of certain drugs, or occur during the course of any of the acute infectious fevers. The urine is scanty in amount and of a high specific gravity. It contains some albumin, red blood-cells, and perhaps some blood-casts.

The associated general symptoms are usually more or less headache, slight lumbar pain or aching, and a general malaise. However, any or all such symptoms may be absent. The condition generally clears up within a very few days, or it may persist as the commencement of an acute nephritis. Owing to the inconstancy of the general symptoms a diagnosis is only made by the evidences of diminished excretion of urine and the examination for the abnormal constituents.

Chronic Congestion of the Kidneys.—This depends for its existence upon an interference with the return circulation of the kidney. The general symptoms are largely those of the disease which produced the interference and was originally responsible for the congestion (cardiac disease, chronic bronchopneumonia,

etc.), to which symptoms are added those of the congestion. The urine is scanty and of high specific gravity, containing some albumin and casts in some cases.

Acute Degeneration of the Kidneys.—This is rather a common disease in infancy and also in later childhood. It occurs with almost uniform regularity during the course of scarlet fever, diphtheria, and acute pleuropneumonia, and is often present also during the course of diseases which are accompanied with a prolonged high temperature. The amount of voided urine is very small. No other symptoms are noticeable except those of the primary disease and the presence of albuminuria. The urine may contain a few hyaline or granular casts.

Acute Diffuse Nephritis.—This may occur as a primary disease, but in the great majority of instances it is secondary to some other process. It is the characteristic post-scarlatinal nephritis which occurs generally in the third or fourth week of that disease. The onset is somewhat gradual. In the bulk of the cases there is a moderate rise of temperature and the height of this initial fever is generally a safe guide to the severity of the disease.

Dropsy is a constant and usually a more or less marked feature, appearing first in the face, then the feet and legs, before it becomes more general. The amount of urine is diminished and albumin is present in considerable quantities. The specific gravity is usually low. There are generally a large number of casts present, also red blood-cells, leukocytes, and renal epithelium. Anemia is a late occurrence.

The active symptoms of the disease persist for about two weeks, then there usually follows a gradual improvement. The period following this may be one of apparent health for a considerable length of time, but with the subsequent development of a chronic nephritis, which is usually not attributed in any way to the preceding acute attack, but which should be.

DISEASES IN WHICH THE EXCRETION OF URINE IS MARKEDLY INCREASED

There are two diseases in which increased excretion of urine is very prominent; these are chronic nephritis and diabetes insipidus.

Chronic nephritis may develop very insidiously in the child, so that it is a long time before attention is attracted to it. The little one may simply show a lack of development for its age, restlessness, recurring headaches, and moderate edema, which have no apparent cause. These may persist for a few weeks and then subside, only to return again. When the history is taken, one finds that months or years before there has been an attack of acute nephritis, or that dropsy followed one of the acute infectious fevers. Age seems to be an important factor, for the occurrence of chronic nephritis is usual before the eighth year of life.

There are two quite distinct types of the disease, and these are—with exudation and without exudation.

Chronic Parenchymatous Nephritis (with Exudation).—This is the type of chronic nephritis which generally follows an acute attack. It follows either immediately or after the acute symptoms have apparently entirely subsided for a considerable period. The urine is quite constantly filled with albumin and casts, and is increased somewhat in amount, unless an acute exacerbation is going on, and then there is a notable decrease. Edema is at times very marked and at other times is hardly noticeable. Anemia is an early accompaniment, and with it are associated nervous symptoms of varied kinds and degrees and digestive disturbances of great variety.

Chronic Interstitial Nephritis (without Exudation).—It is in this type that the amount of urine is notably increased. The color is pale and the specific gravity is low, while albuminuria is infrequent. Dropsy is not common, and when it is present, is only so to a small degree. The result of the mildness of the symptoms at the onset is that the disease usually develops unnoticed. The marked nervous symptoms are generally the first thing to attract attention, and these usually appear abruptly. Intense headache and marked dyspnea are generally the predominating ones. High arterial tension and cardiac hypertrophy are constant features, and the disease, as a rule, ends in acute uremia.

Diabetes Insipidus.—While this is always classed as a disease, we know practically nothing in regard to its etiology, and we are simply dealing with a persistent polyuria. While it is a very rare condition, still childhood is not exempt in any way and the disease

may begin soon after birth. The quantity of urine which is voided varies from five to twenty or more pints in twenty-four hours, and the urine is of a pale color, of low specific gravity, usually of acid reaction, and containing no abnormal constituent.

The onset may be sudden, but a gradual development is the rule, the first thing that is noticed being that urination is frequent at night. An intense thirst causes the child to ingest large quantities of fluid, but the amount of urine voided usually exceeds the amount of fluid ingested. At the same time restriction of the amount of ingested fluid diminishes the amount of voided urine. Usually quite early there are some nervous symptoms, as palpitation, cephalalgia, restlessness, and neuralgic pains of varying intensity.

It is not for some weeks that the general health suffers to any considerable extent. When it does, anemias and general malnutrition are the most prominent disorders, and these are persistent. In infancy there is a consequent retardation of development. The occurrence of a pronounced anemia naturally brings with it all of the symptoms due to marked impoverishment of the blood. The skin is usually dry and hot and constipation is the rule, both of these being due to the excessive extraction of water. The appetite is immense, and the craving for solid food sometimes is about as imperative as the demand for fluids. The temperature is normal or may be subnormal. The condition may continue for years.

The diagnosis must be made from diabetes mellitus, for in many of the symptoms the two are similar; but in diabetes mellitus the urine is of higher specific gravity and contains sugar. A more likely error would be in mistaking the condition for chronic nephritis without exudation. The distinction cannot be made by the presence of albumin in the urine, the existing nervous symptoms, or the polyuria, for all of the nervous symptoms may be similar, the polyuria is a feature of both, and albumin may be present temporarily in both conditions. There are, however, two quite constant features of chronic nephritis of the form mentioned, and these are not present in diabetes insipidus; they are high arterial tension and hypertrophy of the left ventricle. It is well also to remember some of the common factors which influence polyuria in health, as free ingestion of fluid, fright, and exposure to cold. Absorption of effusions, reflex irritations, and hysteria also increase urinary secretion.

THE URINE

The size and the development which the kidneys of the infant have attained by the time of birth would suggest that they had some previous function, and the finding in the liquor amnii of certain constituents of the urine proves their activity, at least.

Urine is normally in the bladder at the time of birth and should be voided within a few hours of birth. It is no unusual thing to find anxious mothers and apparently intelligent nurses insisting that the infant has not passed any urine and claiming that this occurs over a period of one or more days. One must be slow to accept the mere statement, for many times the amount passed is very small and is dried up on the napkin before its passage is discovered. The first urine voided is usually very pale (unless long retained) and of a low specific gravity. The amount passed in the first twenty-four hours is about one and one-half ounces, but with the ingestion of fluids the amount increases, until at the end of the first week it averages eight ounces, with somewhat wide variations which are normal. The act is performed usually ten or twelve times each twenty-four hours. At six months the amount voided is about fifteen ounces; at two years, twenty-four, and at five years, thirty ounces.

For purposes of examination the urine may be collected in male infants by the use of a condom fastened over the penis, and in females by the use of a small cup or vessel. When only a small quantity is needed (as for the examination for albumin), a piece of absorbent cotton may be used. It happens at times that it is necessary to catheterize the infant, and in such cases a small catheter must be used (No. 6, American scale).

Color.—This is much paler in early infancy than in later childhood, although the amount may be small. It deepens when the urine is concentrated from any cause. Diseased conditions naturally influence the color. In fevers it is apt to become particularly turbid, and in young children the color may be quite white. When there is pus present, the urine may become milky white.

Reddish-brown or red urine indicates that blood is present, but hematuria must not be confounded with hemoglobinuria, which is simply due to the presence of blood-pigment. This latter may occur as the result of certain poisons, in the infectious diseases, in malarial fever, and also in a peculiar condition known as paroxysmal hemoglobinuria. The color is usually greenish-yellow when bile is present, and under a good light the green tint seems to predominate at the top of the vessel. Ingestion of phenol or salol may give a similar discoloration.

Urine is pale when it is large in amount or quickly voided, and various things influence the quantity and the rapidity with which it is voided after reaching the bladder.

Quantity.—The average amount voided at different ages has already been referred to, but pathologically it is increased in diabetes insipidus and in chronic interstitial nephritis. There is a diminution during acute congestion, chronic congestion, acute degeneration of the kidneys, acute diffuse nephritis and also during exacerbations of chronic parenchymatous nephritis.

Specific Gravity.—The color is generally an indicator of the specific gravity, pale urine being of low density and highly colored urine high. Density is increased when the amount of urine is scanty from any cause (sweating, fever, lack of water, diarrhea, etc.). Density is decreased when the secretion is in large amounts from any cause (copious drinking, external cold, etc.).

Reaction.—The reaction of healthy urine is acid under normal conditions, but the diet influences this to a degree, as does also the ingestion of certain drugs. This reaction is usually strong during the first days of life, but remains weak throughout the rest of infancy.

Urinary Sediments.—A white, flocculent sediment, composed of mucus and epithelium, is present in nearly all urines after a few hours' standing, and in early infancy the amount of mucus is so large that the urine is normally turbid a few minutes after it is voided.

A dense sediment of a brownish or red color may be due to the amorphous urates, and these are dissolved by the application of heat. The sediment of uric acid may resemble brown or red pepper; the test can be made by the suspected material being placed

in an evaporating dish with a few drops of nitric acid, and as heat is applied, the uric acid dissolves with effervescence. The heat is continued until the material is evaporated to dryness and then it is allowed to cool. If touched with strong ammonia, a characteristic blue or violet color is produced. Yellowish or white sediment may be due to urate of sodium. White sediments are generally due to phosphates or in some cases to uric acid. Yellowish-white sediment may also be due to the presence of pus. Chocolate brown or reddish sediment usually consists of blood.

Odor.—The odor is intensified as the urine is concentrated, and under conditions which cause much concentration the odor may become very marked. The ingestion of certain drugs and some articles of diet impart characteristic odors to the urine. In cystitis the odor may be intensely ammoniacal, and when much pus is present, after standing the urine may have a putrid odor.

So far, we have simply considered those appearances and conditions of the urine which are detectable without chemical examination.

Chemical examination of the urine is treated fully and ably by many works which deal with that subject exclusively, and as such examinations do not differ in any way in children from an examination of the urine of adults, it seems to me that it would be out of place and quite unnecessary to go into details of a subject which is a study by itself. Reference will be made to some chemical processes later on, but there will be no attempt to go into details.

ALBUMINURIA

Accidental albuminuria is the term used to designate the presence of albumin which has been added to the urine with blood, pus, blennorrheal discharge, leukorrheal discharge, lymph, and chyle. The use of the microscope at once detects the presence of these, but it in no way excludes the possibility of some of the albumin present being there because of some associated fault of the kidney. It is always possible that there may be an admixture of albumin from two sources, so that additional means must be taken to determine this fact. To obtain a urine which is free from the different materials mentioned, any one of which may cause albumin

to be present in the urine, it may be necessary to resort to catheterization of the ureters, but, as a rule, this is not needful, bladder catheterization being all that is essential.

In the light of our present knowledge it is exceedingly doubtful if the normal kidney, which is free from the disturbances from which it so often suffers, ever permits the appearance of albumin in the urine. True, there are frequently intervals in which albumin does appear in the urine, and without any appreciable symptoms of a general nature, and this by many writers is called "physiologic albuminuria." But I see no good reason for calling something "physiologic" because we do not understand its cause; in any event "functional" would be a better term, for that word better conveys the idea that the condition is not understood at all, while the other word conveys the idea that the condition must be expected, and therefore it conduces to a careless disregard for occasional albuminuria.

Leaving out of consideration the appearance of albumin in the urine which has already been referred to as "accidental," I believe that one is always safe in assuming that the presence of albumin in the urine is always evidence of one of two things: (*a*) a pathologic condition, or (*b*) a disturbance which acts upon the kidney itself.

The so-called functional albuminuria occurs most frequently in those children who present functional derangements of the nervous system and of the vascular system. This is not true of all such cases, but it is of the large majority. Now, it is a question whether or not a perfectly healthy kidney would allow the presence of albumin in the urine, even under the influence of vasomotor disturbance. Until we have more light upon the subject I believe one is certainly justified in taking the stand that whenever there is albumin in the urine of a child, there is a lesion of some part of the renal elements, which under the influence of vasomotor disturbance allows albumin to appear in an appreciable amount in the urine.

There may be an entire absence of any other symptoms which would aid in the detection of any disease; such symptoms may be beyond detection by our present methods, but the failure to detect can never be recognized as a denial of existence.

Broadly viewed, the occurrence of albuminuria in a child does not indicate that there is anything more than a fault somewhere in the economy. What that fault is, must be determined by other means. Albuminuria alone means little; albuminuria associated with other symptoms of disease means much.

HEMATURIA

Hematuria must not be confounded with hemoglobinuria, which latter is due simply to the presence of blood-pigment in the urine, while hematuria is evidenced by the actual presence of blood in the urine. In slight hematuria the microscope alone reveals the blood-cells in the urine, but where the amount is considerable, the urine may have a reddish-brown or black color. If the blood is streaked through the urine, then the most probable source of the hemorrhage is the bladder or the urethra. If the hemorrhage is from any other point, the blood is thoroughly mixed with the urine or may form tube-casts.

As it is very important to determine at once whether or not blood is actually present, the following test may be applied: Add to the urine one-fifth volume of glacial acetic acid and allow it to stand undisturbed for thirty minutes, at that time adding one-third volume of sulphuric ether and allowing that to remain for another half-hour. Decant the ethereal extract into a small test-tube and add a few grains of aloin. Now, if an equal volume of hydrogen, peroxid be added, a cherry-red color is obtained if blood be present.

Among the more common local causes of hematuria are traumatism (whether from a stone or other foreign body, catheterization, or external violence), new-growths, congestion and inflammation anywhere in the genito-urinary tract, and ruptured veins. The chief of the general causes are hemorrhagic disease of the newly born, purpura, scorbutus, malaria, syphilis, tuberculosis, acute nephritis, and hemophilia. The use of certain drugs may cause it, as turpentine, cantharides, potassium chlorate, phenol, etc.

If the blood is due to the presence of stone, the general condition usually remains good unless suppuration occurs. The pain may be most severe and associated with a rise in the temperature at times. Bleeding is not extensive and is relieved by rest when

the stone is in the kidney. If in the bladder, there is frequent desire to urinate, with an involuntary arrest of the act, pain radiating into the penis, and the blood appears at the end of the act of urination.

Recurrent hematuria may mean that there is a calculus, uric-acid crystallization, carcinoma, or malaria. In carcinoma the hemorrhage is profuse and occurs late in the disease, so that usually the diagnosis has already been made from other symptoms. Malarial hematuria shows a decided periodicity.

In tuberculosis the amount of blood is very small, and if the kidney is affected, pus and the tubercle bacilli are also found in the urine with the blood. When there is tuberculosis of the bladder, the blood is bright red and appears very suddenly and the symptoms are those of cystitis, so that there can be no positive distinction until the tubercle bacilli are discovered in the urine. It is not uncommon to encounter a very considerable hemorrhage in cases of acute nephritis, and especially when it follows scarlet fever. In cases in which a doubt as to the source and the cause exists, it may be necessary to use the cystoscope, urethral catheter, the *x*-ray, or even an exploratory incision.

HEMOGLOBINURIA

This is distinct from hematuria in that, instead of blood, only the blood-pigment appears in the urine. It occurs in a paroxysmal form in childhood and from an unknown cause, although many have been suspected (chiefly malaria, syphilis, exposure to sudden chilling of the body, and severe muscular exertion). It is associated with more or less fever (101° to 105° F.) which follows a chill or a convulsion. Pain and various paresthesias may be present. Enlargements of the liver and of the spleen are usually observed and there may be some jaundice.

The chief subjective symptom is a more or less intense feeling of anxiety. Between the attacks there is nothing which indicates in any way the cause, the child being in apparent perfect health. Sometimes in the intervals between attacks there is albuminuria, and this may alternate with the hemoglobinuria. The urine passed is generally red or dark brown, and there are few, if any, blood-

cells. The course of the trouble is from a few hours to three or four days. Dilatation of the heart occurs occasionally. The cardiac dilatation, the fever, and the anxiety all suggest a toxic element.

PYURIA

Pus found in the urine may come from any part of the genito-urinary tract, but the most frequent source during childhood is the pelvis of the kidney. Next in frequency it comes from an outside source, as abscesses which open into some part of the tract. When abscess is the cause, there is generally a very sudden appearance of a more or less large quantity of pus, which persists only a short time and gradually disappears altogether within a few days. If the abscess is an old one, the only thing which may be found will be granular or fatty detritus. Pus coming from the pelvis of the kidney will mean different things as the condition may be acute or chronic. If acute, then it is suggestive of pyelitis; if chronic, then it indicates either calculi or tuberculosis of the kidney.

Pyelitis.—The symptoms in themselves are not suggestive enough to allow of a diagnosis without an examination of the urine. During and following one of the acute infectious diseases pyuria may be the only symptom which is present. Usually the attack begins suddenly with repeated chills, a high and fluctuating temperature, and diminished secretion of urine. Symptoms referable to the nervous system are then rapidly added, and loss of weight is generally rapid.

Up to this point many diseases will be suspected, but there is a marked obscurity about the symptoms which renders the possibility of the diagnosis of one of these unreasonable when the facts are well balanced. The examination of the urine reveals the presence of pus. Then the question arises whether it comes from the kidney or from the bladder. Pus from the bladder is of rare occurrence among children, and if the source of such is an abscess, then we observe the local signs.

If upon examination we find an acid urine containing large quantities of pus and moderate quantities of epithelial cells from the bladder, pelvis, and tubules of the kidneys, with perhaps a few

hyaline casts, and this is associated with chills and fluctuating temperature, the diagnosis of pyelitis is almost certain. When pyelitis is chronic, pyuria may be the only symptom for a long time, but later on there is usually a tumor due to the associated pyonephrosis. One characteristic of the chronic form is the marked tendency to acute exacerbations.

Tuberculosis of the Kidney.—This is immediately suggested by the existence of a chronic pyuria. It is a rare disease and one whose symptoms are so indefinite that they are overshadowed by the general symptoms of tuberculosis of which they are a part. The diagnosis is made when, in the presence of an unmistakable tuberculous infection in some part of the body, we find that there is pain in the region of the kidney and some pus in the urine. To make the diagnosis positive, it is necessary to examine the urine to detect the presence of the tubercle bacillus.

ENLARGEMENT OF THE SCROTUM

An enlargement of the scrotum may be due to one or both of two things—an increase in the contents or an increase in the thickness of the walls.

Under perfectly normal conditions the skin of the scrotum is thin and tender, and because of the many folds, it has a corrugated appearance. Under the influence of edema and of inflammation, both of which cause more or less swelling, this corrugated appearance of the scrotum is lost. In edema the skin has a pale color, there is absence of pain, and upon pressure pitting is observed. The penis is also almost invariably involved in the process.

Under the influence of an inflammation the skin becomes hot, dry, and reddened, and there is more or less pain present. The usual causes of such an inflammation are erysipelas and injury, the latter being the less frequent. If the scrotum is swollen, but the skin remains normal, then we are certain that the enlargement is due to an increase in the contents.

At once the question will arise as to whether we are dealing with an inguinal or a scrotal hernia, or with a swelling of the testicle. Hernia is usually easily reduced when the effort is made with the child in the prone position, and, further than that, the reduction generally takes place suddenly. On the other hand, hydrocele gives us an oval tumor with a smooth surface; it is fluctuating and irreducible. Orchitis is very rare in childhood.

Hydrocele.—This consists of an accumulation of serum in some part of the serous pouch which is brought down by the testicle in its descent or may be (in infants) due to an incomplete closure of this pouch at some point where fluid accumulates. There are several varieties.

Congenital hydrocele differs from the simple variety in that it is due to an anatomic defect. When the testicle passes into the scrotum, it carries with it a portion of the peritoneum which should normally be obliterated at its neck. The lower portion then forms the tunica vaginalis testis, making a double vesture for the testicle.

The testicle does not lie in the cavity, but external to it. If the neck of the sac remains open, the abdominal wall must be defective at the internal abdominal ring, predisposing the child to congenital inguinal hernia and also to a determination of the abdominal serum to the bottom of the sac, thus forming a congenital hydrocele. Thus we commonly observe the two conditions associated.

The diagnosis is easy. The fluid content is easily reducible into the abdomen, and in some cases this is accomplished by position alone, while in still others pressure is required. A valuable point to remember is that in either event the reduction is gradual and in marked contrast to the reduction of hernia, which is sudden and *en masse*. However, if the two be associated, then there is a sudden reduction of the hernia, with a gradual reduction of the hydrocele following. The tumor caused by hydrocele is translucent.

Encysted hydrocele of the cord may occur in the connective-tissue sheath or in a portion of the peritoneal elongation which has not been occluded. The size may be as large as a hen's egg or smaller, and such cysts are tense, oval, smooth, and slightly tender to pressure. Fluctuation is hard to determine on account of the tension.

The cysts are generally found between the external ring and the testicle, or in the inguinal canal. The diagnosis must differentiate hernia, as the long axis of the cyst is parallel with the cord, but the tumor is irreducible. Undescended testicle would hardly be suggested, for an examination will reveal it in its proper place. Sometimes, it may be necessary to make an exploratory incision for positive diagnosis.

Hydrocele of the cord is the rarest of all varieties, and in this form the scrotum remains normal and the testicle is in proper position. The tumor is reducible, small, and entirely above the scrotum. It may fill the inguinal canal, but may be complicated with hernia, in which contingency the same methods of diagnosis are used as in the above-mentioned congenital form.

Hydrocele occurring in females offers some difficulty in diagnosis. Tumor of the labia majora, or tumor occurring in the inguinal canal, is strongly suggestive of hydrocele, but the differen-

tiation must be made between inguinal hernia and also pudendal hernia. Absence of pain or of any of the signs of inflammation would serve to distinguish it from vulvovaginal cysts or abscess of Bartholin's gland.

Orchitis.—As a primary disease this is very rare, and as a secondary one to epididymitis is almost unheard of. The most common cause is an attack of parotitis. The children who are most susceptible to orchitis during an attack of mumps are those who are approaching puberty. As a rule, but one organ is affected, and this occurs about six to eight days after the attack of mumps. The duration of the disease is from four days to two weeks. Injury and acute infectious disease are rare causes of orchitis.

If one discovers a small round tumor, which is about the size of a walnut, and is located in the inguinal canal, easily reduced, but reappearing under the influence of abdominal pressure or abdominal muscular action, one may be dealing with either a hernia or an impacted testicle. The first point to be determined would be the presence or absence of the testicle in the scrotum on that side. Absence would at once suggest that the testicle was impacted. The only possible chance of error would be if dropsy was localized at that point from any cause; but, being somewhat scattered by pressure, its gradual return would at once help to distinguish it.

Chronic enlargements of the scrotum are almost invariably tuberculous or syphilitic. In both diseases the development is very slow, there is practically no pain during the development, there is an irregular surface, and there may be soft areas also. The differentiation must take into consideration the associated symptoms of the disease in other parts and the history of the child.

HEADACHE

Until the child reaches the age of five years it is not a simple matter to recognize the existence of headache. In a measure this is true of all painful sensations, for the little one does not definitely locate the site of pain, but usually complains in a general way. Even in a child who talks well and is of average intelligence pain is not definitely located.

Headache in children under five, despite its difficulty in recognition, is not of common occurrence, except in connection with diseases of the brain and meninges. Recognition of headache in the very young is possible only when it is very severe, and then the usual manifestations of its existence are pulling at the hair or the ears, with almost continuous rolling of the head from side to side and contraction of the muscles of the forehead. There are associated general restlessness and crying.

In childhood the occurrence of headache is of far more importance than a similar condition in adult life, and the only safe way of dealing with it is as an important symptom whose cause must be satisfactorily explained before it is dismissed. If this symptom is treated lightly, it will lead one into serious error, and the younger the child, the more forcibly this applies.

For diagnosis, headaches may be divided into those which are acute and those which are chronic; this division will be followed.

ACUTE HEADACHES

The acute headaches of children are almost always associated with a rise in the temperature, and the first thing that must be determined is to what extent the headache is due to that rise of temperature. This is decided by the intensity of the fever and the character of the headache.

In regard to the intensity of the fever, headache is very rare when the temperature is under 103° F. unless there is disease of the brain or the meninges present, and then it may be intense, with a

lower temperature. The character of the headache is such when due to a rise in temperature that it is readily relieved by pressure over the temples, by the application of cold, by massage of the veins of the neck, and is increased for a while by active motion. It is true of all febrile conditions in children that they are usually associated with headache of a more or less moderate degree.

In determining the existence of headache it is necessary to eliminate tenderness of the scalp which simulates headache. It is not uncommon to find that the scalp is the site of one or more circumscribed foci of inflammation, and these cause pain. Then, again, but not so commonly, rheumatism shows most of its manifestations of a painful nature in the aponeurosis of the scalp, and the child complains as of headache. Palpation soon discloses the presence of either of these conditions.

Toxic Headache.—These acute headaches are due to absorption of toxins from the alimentary tract, and are usually brought about by constipation or overfeeding or may be due to the toxins of the infectious diseases. If an acute headache occurs in a child who is already the victim of kidney lesion, it should at once excite suspicion of uremia, and this must be regardless of the fact as to whether there is fever present or not.

Tuberculous Meningitis.—The headache of tuberculous meningitis is usually continuous and very severe, and bears absolutely no relation to the intensity of the fever, which is usually low. Generally speaking, the greater the disproportion between the rise of temperature and the intensity of the headache, the more indicative it is of meningitis. There is a reason for this, for the commonest form of meningitis in childhood is the tuberculous, and one of the chief features of the disease is the low temperature range.

Purulent Meningitis.—If the child is affected with a purulent meningitis, the temperature runs high, but this form is comparatively rare in childhood, and when it occurs, the cerebral symptoms are usually so marked that they rapidly aid in clearing up the diagnosis. The same might be said of cerebrospinal meningitis.

Simple Meningitis.—The headache is usually very severe and continuous, just as in the tuberculous form of the disease, but the temperature is higher and the onset of the disease much more ab-

rupt, so that headache appears early as a symptom, and generally within twenty-four hours of the onset headache is severe.

Headache due to Disease of Organs of Special Sense.—In the ears there may be the presence of foreign bodies or of acute ostitis. The eyes may be the site of an acute conjunctivitis, or keratitis, iritis, or acute strain may be the cause. In the nose there

Fig. 96.—Diagnostic significance of the site of headache in children.

may be rhinitis or foreign bodies. Catarrhal inflammation of the frontal sinuses usually causes acute headache which is severe. There may be little or no elevation in the temperature and the child is not visibly ill, but the headache is marked. The presence of "snuffles" may be the only thing to attract attention to the nose.

CHRONIC HEADACHES

By the term chronic in this connection I do not mean to imply that the headache is continuous over a long period only, but include all such headaches as are prolonged and recur, as well as those which are transient in their course but recur from time to time.

Chronic Headache due to Disease of Organs of Special Sense.—In the ears there may be impacted foreign body or chronic ostitis. The eyes may be the cause of the headache, being the site of muscular weakness, strabismus, errors of refraction, keratitis, or iritis. In the nasal passages there may be impacted foreign body, polypi, hypertrophic rhinitis, or adenoid vegetations.

Tumors of the Brain.—These are not rare in early life, but the etiology is obscure when we leave out of consideration injury and tuberculosis. Of all the symptoms, headache is usually the most prominent, being persistent, generally very severe, and may be intense. Not uncommonly it occurs with most marked intensity during the night and in the early morning.

Closely associated with the headache there are vomiting and vertigo. The result is that for a short time these cases may simulate headache from disordered stomach. The vomiting, however, is of the projectile type, and shows no regard for occurrence in relation to meals. Like the headache, the vomiting and vertigo are persistent, making in all three very suggestive symptoms.

In about four-fifths of all of the cases optic neuritis accompanies cerebral tumor. The ophthalmoscope is necessary for recognition of this. In an early stage of the disease general convulsions are common, but there are usually long periods between the occurrence of convulsions at first. This leads to a belief that the seizures are due to other causes. All degrees of convulsions are observed, from simple twitchings to severe and typical epileptiform seizures. Localized spasms commonly precede the onset of general convulsions.

The mental symptoms show the greatest variety and complexity, and such symptoms are so frequent in childhood in the course of disease that they are not apt to excite suspicion for a considerable time. However, any child who exhibits headache associated with vomiting and vertigo, all of which are persistent (even though not at first severe), and at the same time is persistently and increasingly somnolent, must at once be regarded with suspicion.

Sometimes somnolence is not present, however, until near the end, but there are still three characteristic symptoms—persistent headache, vomiting without apparent cause, and optic neuritis. If the vomiting is absent, as is sometimes the case, then optic neuritis is

absent also, so that the most constant feature is headache, and if this is alone present, then there is considerable difficulty in the diagnosis at this stage of the disease. The only thing which appears to affect the severity of the headache is the occurrence of hydrocephalus, and when this is well developed, the pain may disappear entirely.

Nystagmus may occur with a tumor in any situation, but is most common late in the disease. Hydrocephalus also may occur with a tumor in any situation, but if early and severe, it indicates that the lesion is obstructing the sylvian aqueduct or the fourth ventricle.

Local Symptoms.—It is not uncommon to observe a lesion of the frontal lobe without obvious signs. At other times there is some degree of mental impairment, which may be slight or amount to imbecility. When severe, the lesion is usually found to be bilateral.

Inability to write indicates involvement of the left second frontal convolution and motor aphasia of the third frontal gyrus. Sudden loss of consciousness or impairment of it, associated with automatism, is characteristic (may occur also in temporal and occipital lesions). From pressure of the tumor there may occur brachial, facial, or crural monoplegia, or even hemiplegia which occurs gradually. There may be unilateral or bilateral anosmia. Blindness is not uncommon.

If there are lesions which are destructive to the central convolutions, then we observe paralysis of voluntary motion in the corresponding parts of the body, or there may be simply a marked weakness. Inability to localize touch and irritative phenomena are quite common. Localized epilepsy is among one of the early symptoms, but rapid spreading of the same is frequent, so that Jacksonian convulsions may involve the whole of one side of the body.

Of the occipital lobe, the most characteristic local sign of tumor is homonymous hemianopia. There may be sensory epilepsy, visual hallucinations, and visual aura. Of the temporal lobe, there may be mental alteration without other symptoms. When other signs occur, they are deafness, word-blindness, word-deafness, or total loss of speech. Hallucinations of smell and taste are common, but not their loss.

When the internal capsule is involved, the chief local signs are hemiplegia, hemianesthesia which is never absolute, and hemianopia. Tumor of the pons varolii presents the unusual combination of hemiplegia with crossed facial anesthesia. Ataxia is common, as is also intention tremor. Spastic paralysis of the face may occur, also deafness and hemianesthesia.

Affection of the medulla exhibits atrophic paralysis of the lips, tongue, palate, pharynx, and larynx. But lesions in this situation are usually early fatal, so that they are not observed to any extent. The signs of cerebellar involvement are mostly dynamic, and to be well demonstrated the general mental and physical condition of the child must be reasonably good.

Hemiataxia (on side with lesion) is frequent, being more pronounced in the upper than in the lower limb. Movement is uncertain and unsteady when attempt is made at finer adjustments. In about three-fourths of the cases the head is inclined to the shoulder of the same side as the lesion, the face being turned slightly to the opposite side. This is noticeable most in the sitting position. When standing, the body is bent toward the side of the lesion and there may be a tendency to fall that way, for the child is very unsteady. While walking, the child does so with a lunge and tends to progress in a curved line. Sometimes there is a bilateral ataxia with a forward bending of the body, or there may be retraction of the head with backward inclination of the body. Nystagmus is generally marked, and irritative phenomena are sometimes very prominent.

There has been no attempt to do more than suggest some of the more prominent of the many local signs of tumor in different parts, and for a complete description of detail reference must be made to some of the works upon that special subject.

The diagnosis is at times difficult, and for a period may be impossible. When optic neuritis exists alone or is associated with headache and vomiting, it at once leads to a suspicion of organic disease of the brain, or of kidney disease, lead poisoning, or anemia.

The last two are usually easily eliminated, for there is a history of lead colic and the presence of the lead line in the one, and in the other the impoverishment of the blood must be very marked to cause such symptoms. Also in anemia the neuritis is of rapid

development compared with that of tumor, and the influence of treatment is quickly apparent. In kidney lesions, there is the presence of albumin in the urine, the headache is not so intense or so constant, and there is an entire absence of the focal symptoms.

If basilar meningitis is slowly developed, it may simulate cerebral tumor, but in the latter there is an absence of fever, of the slow and retarded pulse, of constipation, of retracted abdomen, and the pupillary changes. The onset of tuberculous meningitis is more rapid than that of tumor, and the prodromes, the wasting, and the history are all sufficiently marked to make the distinction soon clear.

In some instances the symptoms of a slow onset of local signs with a progressive course are not due to tumor (although they markedly resemble such), but are occasioned by an enlarging focus of disseminated sclerosis involving one of the peduncles of the cerebellum. In these cases the optic discs are pale and the other symptoms appear finally, although they may be long delayed. Hemorrhage could hardly be mistaken, for the onset is so sudden, and, in marked contrast to tumor, the symptoms show progressive improvement instead of becoming progressively worse.

Cerebral Abscess.—This disease has much in the line of symptoms which is similar to cerebral tumor, but not with the same severity. A rare condition at best, it is usually diagnosed at the autopsy table—not before. Abscesses are generally secondary (probably always so), and the conditions which are most liable to cause them are disease of the middle ear, traumatism, caries of the cranial bones, and suppuration in any part of the body.

The first symptoms are usually masked, so that they are considered as a part of the original disease which is present. Knowing this fact, one should be suspicious when the symptoms of chills, headache, vertigo, and vomiting occur during the course of a disease which might lead to the formation of brain abscess. They should be explained upon other grounds before we can feel at ease. Such symptoms may persist for one or two weeks, all the time increasing and terminating in death.

Or, on the other hand, they may remain acute for a short time and then subside (this is the usual course, and the one which leads to so much error), so that for months there is nothing noticeable

except occasional headache, vertigo, or nausea. Then, like lightning out of a clear sky, acute symptoms occur of an acute meningitis or sudden coma, which prove fatal within a very short time. Then, when the autopsy is performed, there is found an encysted abscess which has ruptured.

It is the associated meningitis which is so common which makes the diagnosis of abscess so difficult, and the youth of the child adds obscurity to all but the motor symptoms. If a sufficient etiologic factor is present and there occur headache, vertigo, and vomiting which are recurrent, it is suggestive; and if there are added to these Jacksonian epilepsy seizures and focal signs, the evidence is still stronger.

Migraine.—This autointoxication or intestinal intoxication finds its chief expression in paroxysmal headache. There are many predisposing causes, as the age (late childhood), constipation, poor surroundings, excessive feeding, etc., but far and beyond any of these is the marked influence of heredity.

This predisposition is at once noticeable, and the family history is plainly neurotic, with rheumatism and neuralgic conditions predominating. With the predisposition it requires but a slightly active cause to bring about an attack, so that if one attempted to enumerate the active causes, they would constitute a legion. Any condition, no matter how it is brought about, or at what time, which acts as a temporary cause of innervation, may bring on an attack.

There is no question but that among the active causes, just as among the predisposing causes, one stands out prominently—liver incompetency. There may be the occurrence of certain prodromes, and when this is the case, the child is usually aware that an attack is about to occur. These are varied, but the most common are vertigo, ringing in the ears, spots before the eyes, and giddiness. Such may occur a few minutes or a few hours before the onset of the characteristic headache, which is unilateral and of rapidly increasing intensity. The pain is throbbing in character and intense, continuing, as a rule, for several hours. It is increased by motion and by light, so that the child naturally seeks a darkened place in which to lie down.

Nausea occurs usually quite early in the attack and increases

in its intensity until vomiting occurs, and with this last event the paroxysm is terminated for the time being. After the vomiting the child generally sleeps, and awakens refreshed and apparently perfectly well. At times the headache and the nausea and vomiting are all mild, and the sleep which follows the attack is the prominent symptom, being so profound that it almost resembles coma. When this occurs, the mental condition usually remains somewhat sluggish for twenty-four hours, but not longer than that.

The temperature throughout remains normal or nearly so. The duration of the attacks is a few hours to two days—rarely longer. The intervals between the paroxysms vary, but the average is of one month. The paroxysms do not repeat themselves upon successive days, so that such a history would at once be against migraine as the cause of the headache. The chief characteristics are the paroxysmal occurrence of headache, the marked hereditary influence in its production, and the unilateral situation of the pain.

In the diagnosis from other forms of paroxysmal headache an examination of the urine is important. It is high-colored, with a high specific gravity and with an excess of uric acid, the purin bodies, and the xanthin bases. As the condition becomes more and more chronic the typical character of the symptoms may become diminished, but the history of previous typical attacks leaves practically no chance for an error in the diagnosis. The closest similarity is exhibited by neuralgia of the supra-orbital nerve (see below).

Neuralgia of the Supra-orbital Nerve.—The pain in this condition is very similar in character and location to that of migraine, but as the paroxysms are in nearly every instance due to malarial infection, they are periodical. When vomiting occurs, it is usually at the onset and not at the termination of the attack. Pressure over the nerve increases the pain, so that the condition is easy of recognition.

PARESTHESIA

This is a perversion of normal sensation. Visceral paresthesia is an abnormal sensation which is referred to some viscus and is not a mere diminution or excess of the normal sensations. The sensations referred to are not in any way limited in number or

variety, but the more common ones are those of heat and cold, itching, burning, tingling, and numbness. Paresthesia is almost entirely limited in its occurrence to children who are in a chronic state of malnutrition, and in them it is not infrequent.

When it is referred to as a more or less general sensation, without definite localization, or when it is constantly changing in its situation, it is merely indicative of the general poor condition of the child and of blood impoverishment. On the other hand, if it be definitely localized and persistent in its nature, it becomes of some definite diagnostic value, indicating some disturbance of the nerves which supply the affected area.

VERTIGO

This is a disordered condition of the sense of equilibrium, giving rise to a feeling of unsteadiness and the sensation of an apparent movement of the body itself or of surrounding objects. In childhood it is closely associated with disorders of the stomach, ear, and eye, and in the order named as to frequency. The condition ought not to be considered lightly, but the cause must be sought for and eliminated if possible.

It will be necessary to reassure the parents that the condition is not one of danger, for usually there is considerable alarm expressed in regard to its occurrence. The first consideration should be an examination into the condition of the digestive apparatus, for it is in some fault of the gastro-intestinal tract that nine-tenths of all vertigos have their origin.

Adenoid vegetations, by their interference with the general health of the child, and also acting as a local cause, are responsible for many of the cases of vertigo. At times there also occurs an accompanying deafness, which persists for some minutes after the occurrence of the vertigo, so that sudden and transient vertigo and deafness occurring in a child are at once suggestive of adenoids. The influence of eye-strain would indicate itself by brow headache, by a watery condition of the eyes when they were put to use, and by the evident straining which takes place to overcome the deficiency in sight while the child is at close work.

Of course, vertigo occurs as part of other conditions, and most

notably in night terrors and in epilepsy. In the latter it may be a rather prominent symptom, so that the patient, when he feels the sensation coming on, actually turns about to maintain his balance, but quickly falls and becomes unconscious. In other instances the vertigo is described as accompanied by a noise, which is rushing in character. Auditory vertigo is a common accompaniment of cerebral tumor and cerebral abscess. Attacks of vertigo are common in the so-called functional heart disorders of childhood.

DISTURBANCES OF CONSCIOUSNESS

Loss of consciousness may have a gradual or a sudden onset, and either type may exhibit varying degrees of completeness.

The least marked of all forms is that which is known as *somnolence*, and which is characterized by a persistent drowsiness from which the child is readily aroused. *Stupor* is more marked in degree, and is evidenced by a persistent sleepiness from which it is difficult to arouse the child, and when this is done, it is only for a very short time.

Coma is still more profound, and it is impossible to arouse the little one, no matter how severe the measures used. *Coma vigil* is evidenced by the child lying with open eyes, but remaining absolutely unconscious. There may be an associated delirium, with active movements of the extremities.

Diagnostic Significance.—Somnolence has no special significance, except as it is the first stage in a gradually developed coma and so indicates the occurrence or imminence of such. Stupor is observed also as the condition between coma and somnolence, but irrespective of this connection it is observed most frequently in asphyxia from any cause. Coma may be suddenly developed, as is typically seen in insolation. Syncope is a sudden loss of consciousness which is due to brain anemia, and such may occur from violent muscular exertion, independent of insolation.

When coma is gradually developed, it may depend upon one or more of several conditions. It is the usual accompaniment of narcotic poisoning and uremia. It may accompany any of the febrile diseases, and particularly the acute infectious ones, pyemia, septicemia, emboli and thrombosis of the brain, injuries to the head or brain, or to inflammatory disease of the same. It is usual after attacks of eclampsia and occurs with epilepsy.

Poisoning from opium is evidenced by very deep, slow, and shallow respirations and an infrequent but full pulse. There is

normal temperature and the pupils are markedly contracted, but equally so, which latter is very important to determine.

In uremia it is rare that unconsciousness develops without convulsions. The pupils are either normal or equally dilated, and the pulse of a high tension and infrequent. No reliance can be placed upon the temperature. Edema is usually evident in some portion of the body.

The coma occurring with epilepsy offers little difficulty in distinction. There is the history of the fit, but, even regardless of this, there is usually the evidence of such in the bitten tongue and the bloody foam (clear when no injury occurs) about the lips. The face is greatly congested and the breathing stertorous. Coma is of short duration, showing progressive improvement until full consciousness is restored. Almost invariably the bowels and bladder have been evacuated during the seizure.

Syncope is readily recognized by the pallor of the face, which is so marked, by the weak pulse, shallow and almost imperceptible respirations, and the widely dilated pupils as they are seen through the partly open eyes. The cause may be evident and is usually an emotional one. If there are added to the foregoing symptoms cyanosis and some stertor, the cause is probably a cardiac one.

Insolation would be suspected from a history of exposure, in the heated term, and if the skin was unusually dry and hot. The conditions under which the child is found would help in determining the occurrence of poisoning from illuminating gas and from alcohol. Hysteria is rarely the cause of coma, and the disease itself is rare before the seventh year. The coma is never deep, and the stigmata of the disease are usually well marked.

DELIRIUM

This state of mental agitation is evidenced by marked restlessness, incoherent mutterings, delusions, and sensory perversions. It may be active, in which state it is difficult to restrain the child, or may be muttering, in which the little one lies quietly enough but with very evident mental agitation.

Delirium occurs with great frequency during the course of febrile diseases and quite regardless of the intensity of the pyrexia.

In some conditions it is more evident with low temperatures than in others, and this is particularly true of typhoid fever, in the course of which it commonly occurs. It is intimately associated with inflammatory cerebral disease, the septic infections, and uremia. In hysteria it may be marked, as it is in the insanities, both of which are not common to childhood.

CONVULSIONS

A convulsion is a series of muscular contractions which, while they are involuntary, affect the larger portion of the voluntary muscles of the body, causing thereby spasmodic movements. The most natural division is into those which are clonic, or epileptiform, and those which are tonic, or tetanic. As a rule, tonic convulsions have their origin in the motor tracts of the spinal cord; those of the clonic type, in the cerebral cortex.

A spasm is a violent involuntary contraction of a muscle, producing rigidity of the same, which is either immediately followed by relaxation (clonic spasm), or which remains unchanged for a considerable length of time (tonic spasm), hence, generically, any involuntary and rigid contraction, especially the constriction of a canal, orifice, or hollow organ.

The term "spasm" is applied to a contraction of either the voluntary or involuntary muscles, while "convulsion" denotes contraction of the voluntary muscles, producing visible movements, particularly one in which a number of the muscles are involved and the movements are more or less complicated. For exactness in diagnosis it may be well to bear the distinctions in mind. To the laity, however, there is absolutely no difference; convulsions are called spasms (and vice versâ), fits, and spells.

In taking a history care must be exercised to find out exactly what condition is being described, as the admixture of terms is so common. There are two quite natural divisions in which convulsions or spasms may be placed—those accompanied with loss of consciousness, and those in which consciousness is retained. The first division may again be separated into—(*a*) those associated with a rise of temperature, and (*b*) those in which the temperature remains normal. For the sake of clearness such a division will be followed in this section.

In many of the cases certain signs indicate that convulsions are threatened; these are irritability, restlessness, and sudden twitchings of the muscles of the face, arms, or legs. The last two are

most noticeable during sleep, because at that time voluntary inhibition is not active. In the majority of instances, however, the onset is sudden and without warning. Sudden pallor of the face is immediately followed by rigidity of the muscles; the eyes are rolled upward and become fixed, and spasmodic contractions of the muscles occur rapidly, until the major part of the musculature is involved. The contracture of the facial muscles causes peculiar grimaces, and the fingers are usually tightly clinched over the thumb, which is thus buried in the palm.

The following symptoms, or some of them, may also be present, but are by no means constant: frothing at the mouth; unnatural rattling or gurgling sounds, which are produced in the larynx; cold perspiration over the head; and evacuations of the bowel or urine.

The severe spasmodic movements usually persist for three or four minutes, leaving the child relaxed, exhausted, and in a condition of more or less profound sleep, from which there may be a bright and conscious awakening, or a semiconscious state persisting until the advent of a second convulsion. This sleep may at times resemble true coma.

During the attack there may be spasm of the respiratory muscles, the breathing being shallow, irregular, and spasmodic, and accompanied with more or less cyanosis. It must be clearly understood, however, that the whole symptom group as described may not occur in every case, for there are all degrees of variety and severity, from slight twitchings to that type which may immediately destroy life. No matter how slight, the only necessary symptoms of eclampsia in the child are unconsciousness and clonic or tonic muscular contractions.

It is hardly probable that an attack of convulsions would be unrecognized, even if not observed, for the parent's description of such an attack is usually vivid enough to preclude any error. The difficulty will come in diagnosing the cause of the convulsion, and this must be done as early as possible, for without such knowledge there can be no intelligent treatment.

Before we take up the diagnosis in detail, I think that a few general statements will be helpful.

The very young infant is comparatively free from convulsive

seizures, because during the first three months of life acute systemic bacterial toxemias, which are so potent in the production of convulsions, are not frequent. Then, again, stimulation of cortical motor centers and of the convulsive centers at the base of the brain does not easily excite convulsive movement, because the nerve force discharged from these centers is hindered by the underdevelopment of the myelin sheaths of the fibers of the pyramidal tracts. These sheaths are developed gradually, so that at the third or fourth month the pyramidal tracts have their functions sufficiently developed to bring the spinal cells and the cerebral convulsive centers in close touch.

From the third month until the end of the second year all of the nerve-centers of the infant are most irritable, so that convulsions are more common. Along with this irritability there is an enfeebled inhibition, so that there is only a mild restraining influence exercised over spinal reflex movements. After the second year of life the nervous system is less irritable and inhibitory control is better, so that convulsions are less frequent.

CONVULSIONS IN THE NEWLY BORN

Convulsions are at times present in the newly born infant, occurring immediately after birth, or in some instances a few days later. Such convulsions are always of serious import. The cyanosis which is so commonly associated with these early convulsions is the result of the abnormality which accompanied the birth, and as long, tedious labors are most apt to occur with the birth of first children, we see sufficient reason for the fact that the large majority of early convulsions occur in first children. On the other hand, rapid birth may result in injury to the child directly or indirectly by establishing an instability which makes it liable to convulsive seizure.

These early convulsions are usually severe and persistent. They may be unilateral, but do not long remain so, as a rule rapidly becoming general; or if they remain unilateral, they are not confined always to the same side. A persistent one-sided convulsion is markedly indicative of local cortical injury, but to be attributed to this cause it must be persistent and all other

causes excluded. It is not uncommon to find that after the convulsions have ceased, even though they be of a moderate type, some weakness of the affected musculature is present.

There are two conditions present which produce the irritability which gives rise to these convulsions—venosity and structural change inside the skull.

CONVULSIONS WITH FEVER AND LOSS OF CONSCIOUSNESS

Febrile Convulsions.—All conditions accompanied with a very rapid elevation of the body-temperature, which would ordinarily be associated with a chill in the adult, may be accompanied by convulsions in the child. Usually the convulsive attack is the substitute for the chill which occurs in later life. If we except the first three months of life, then the younger the child, the more forcible this statement is.

To be sufficiently assured that the convulsion is caused by the elevation of the temperature, one must take into consideration four factors:

(*a*) The age of the child. It is very unusual that a child over the age of three years has an attack of convulsions as a substitute for a chill. Between the end of the third month and the end of the second year such convulsions are common, but during the third year and thereafter the assignment of fever as a causative factor should be more and more guarded. More often the cause of the convulsion is the toxemia which is itself the cause of the fever.

(*b*) The temperature must be high and developed rapidly. Under 103° F. convulsions from fever are quite uncommon. Now, if the rise of a high temperature has been somewhat gradual, extending over a considerable period, one is not justified in attributing the convulsion to the temperature rise. Allowance must be made for the possibility, however, of a sudden elevation of temperature occurring during the course of a low or gradually developing fever.

(*c*) The convulsions must occur early; that is, within the first twelve hours of the febrile movement. If they occur later than this, the cause should be looked for elsewhere. Usually the con-

vulsion is such an early occurrence that it is the first thing to draw attention to the disease of the child.

(*d*) There is practically no tendency to relapses; the convulsion is not repeated, as a rule, is easily controlled, and the child quickly recovers its senses. One exception to this is that rare disease, the malignant type of intermittent fever, in which the sense recovery is rapid but the convulsion is repeated.

Convulsions from Acute Bacterial Toxemia.—This is by far the most prolific cause of convulsions during infancy. Soluble products of bacteria capable of bringing on convulsions by their action upon the convulsive centers may be formed within the blood and tissues. This is encountered in the acute infectious diseases which are so prevalent during childhood. They may also be formed in the intestinal canal, as in the acute gastro-intestinal infections which are common to infancy.

The intestinal form of bacterial toxemia being more common in early infancy (three months to one year), it follows that convulsions occurring during this period would suggest the probability of acute intestinal toxemia, and, on the other hand, the systemic infections being more common later, would indicate the onset of some one of the acute systemic bacterial infections. These are merely suggestive, however, never absolute.

Convulsions of this type are very apt to be repeated, and whether they are or are not, the senses are liable to be left somewhat dulled. Such convulsions are especially apt to accompany the onset of lobar pneumonia, scarlet fever, variola, and some cases of rubeola. When they occur at the onset of these, or any of the other infectious diseases, they indicate the severity of the infection.

In determining the cause of the convulsion one must make a very comprehensive study of each individual case. This would include:

Age, which has already been alluded to in detail.

Hereditary influences: there is no doubt that the tendency to convulsions may be an inheritance, and this is indicated by the occurrence of convulsions from trivial causes in a whole family of children. Without a well-defined history of such, one must be loath to give this any prominence.

Previous condition: If the convulsion was preceded by any of the usual prodromes of the infectious diseases, this would aid one in diagnosis. (See "Acute Infectious Diseases.")

Surrounding and present general condition of the child, and especially all accessory symptoms which would in any way help to indicate the nature of the disease.

An examination of the urine should be made under all circumstances, for in this way alone can we feel satisfied in regard to uremia.

Having eliminated as well as we can the probability of intestinal and also systemic toxemia, suspicion is directed to some organic disease of the nervous system, especially meningitis. Now, the types of acute meningitis which would be most reasonably mistaken would be the acute purulent and the epidemic. In regard to the former, we know that it never occurs in a perfectly healthy child, but that there is some definite cause (as otitis or insolation), and without some such history one could readily exclude its existence. The epidemic form of meningitis is not so common, and rarely begins or runs its course with repeated convulsions early in the disease.

It would be very easy to fall into error in diagnosis if one did not remember that not uncommonly lobar pneumonia occurs with repeated convulsions as a very prominent feature. So prominent are these, at times, that the convulsions and the subsequent somnolence almost completely hide the cough and the dyspnea. Such cases occur almost invariably during the first two years of life, and particularly during the first year. Under the influence of hyperemia, other symptoms may be added which would lead one to suspect a cerebral origin; these are, dilated pupils, irregular respiration, and stiffened neck muscles.

This type of pneumonia is almost always confined to the apex of the lung. There are two things which we have to guide us in such cases: the temperature, which is low and more or less irregular in meningitis, with cerebral symptoms of this kind, and the clearness of mind which occurs as soon as the convulsions are controlled when due to pneumonia. Within one or two hours after a convulsion, if it is due to pneumonia, the mind is perfectly

clear, while in meningitis there is a marked dullness, which persists for a long time.

Convulsions of Cerebral Origin.—These are very frequently the accompaniment of both acute and chronic diseases of the brain. Very many errors have been made in assigning a convulsion to a cerebral origin simply because it happened to be unilateral. Such an assignment is not justified, unless the convulsions continue to be unilateral over a protracted period. It cannot be too emphatically stated that unilateral convulsions commonly occur without the slightest indication of cerebral disease.

It is necessary to remember, in the diagnosis of convulsions of a cerebral origin, that:

(*a*) Brain disease does not usually begin with convulsions. An examination of the child, and especially a careful taking of the history, will almost invariably disclose the fact that for some time previous to the attack there have been some indications of brain disease. Frequently it takes just such an examination to bring out the fact of its existence. In the acute brain diseases these indicative symptoms will be headache, somnolence, retarded and irregular pulse, slight fever, mental dullness, etc., and in the more chronic cases there may have been more or less persistent and severe headache, indifference, change of disposition, etc.

(*b*) Brain disease is not usually accompanied with very high rise of temperature (except acute meningitis), and there is a marked tendency to recurrence of the convulsions. If the disease is of a chronic nature, the recurrences of the convulsions may extend over several days or even weeks, with more or less protracted intervals. A recurrence of this kind means one of two things in a child over two years of age—chronic brain disease or epilepsy. In infancy such a statement would not hold so true, for while it is not common, still occasionally there are cases of repeated convulsions, with somewhat lengthened intervals, which are entirely independent of brain disease.

Chronic hydrocephalus is the only chronic brain disease of this period of life, and its recognition is usually easy, because of its characteristic symptoms. So, then, with this disease elimi-

nated in infancy, we know that we are not dealing with brain disease.

The condition of the fontanelle may be a guide in cases of doubt. It must not be forgotten that a protruding and pulsating fontanelle may be the accompaniment of any febrile state. However, if this condition persists after the subsidence of the temperature, or after it is considerably lowered, there must be some other cause for it besides the fever, and that cause is most probably cerebral. If the fontanelle is tense, it is strongly indicative of exudation within the skull, but the reverse is not true, for absence of a tense fontanelle does not in any way exclude the presence of an exudate.

CONVULSIONS NOT ASSOCIATED WITH FEVER

In children under the age of five years it is not infrequent to observe convulsions without any elevation of temperature. That the tendency to convulsions in such cases may be a direct inheritance is indicated by the occurrence of convulsions from slightly active causes in whole families of children. Whether this is due to the direct inheritance of an abnormally feeble inhibitory control or to a general neurotic inheritance of unstable and irritable nerve-centers is hard to determine. But, in any event, one should be guarded in giving heredity much prominence, until it is proved that several children in a given family were similarly affected.

Rachitis is without doubt responsible for the conditions which act as predisposing causes in a large majority of the cases of convulsions in young children.

Any general malnutrition, and especially rachitis, may bring about a peculiar susceptibility of the nervous system to convulsive seizure, and in such a state it requires but a slightly active cause to bring on an attack of convulsions. Usually, under these conditions, the first dentition shows the susceptibility. There is abundant reason why rachitis should induce convulsions; it is a diseased condition, the result of perverted nutrition. Its most characteristic phenomenon is enlargement of that portion of the bones where growth is most active, and such enlargement

is the result of excess of cartilaginous tissue and poor bone modification of this tissue.

A similar lack more than likely exists in the development of the nervous system, leading to an instability of the cells and a consequent tendency to nerve discharge. Undoubtedly inhibition is also weakened.

Convulsions in rachitic children may be unilateral, but they are not frequently of this type. General convulsions are much more common, and although they are not dangerous to the life of the child, there is but little doubt that they favor the development of epilepsy in later life.

A fairly large proportion of the cases are associated with that condition known as laryngismus stridulus, although it may require some close questioning to bring out the history of the latter. Unless the attacks of laryngismus have been marked, they will go unnoticed or be attributed to something else. Generally, mild attacks are considered as an evidence of temper; under excitement of any kind the child will hold its breath for a considerable period, and this may be done repeatedly. It is in just such cases that a careful examination shows other evidences of rachitis. The statement cannot be too strongly made that a child may be rachitic and yet, as far as looks go, appear to be perfectly healthy except for a slight anemia.

There are a large number of slight causes which may bring on an attack of convulsions in some infants and children which would have no influence upon the average child of corresponding age, and, underlying this, there is generally some condition of malnutrition. Every one of these causes must receive thorough investigation, for they are not sufficient in themselves to bring on a convulsion, but act as the active cause of an underlying condition (usually rachitis).

Just a few of the more common of these will be mentioned: passive hyperemia of the brain from pertussis, difficult urination from any cause, but more particularly from phimosis and calculi, constipation, partaking of unsuitable food, fright, and dentition. Causes acting from without are: suckling soon after an exhibition of one of the strong emotions (especially anger) in the nurse, suckling of an intoxicated nurse.

Whenever the active or the remote cause is in doubt, a thorough examination of the urine should be made, irrespective of whether there is or has been any evidence of disease of the kidney or not. In every case of convulsions in childhood this procedure is a valuable one.

Convulsions without any elevation of temperature, occurring in an infant, would have as their most improbable cause epilepsy; while, on the other hand, if such convulsions occurred in a child over four years of age, epilepsy would be the most probable diagnosis.

Epilepsy.—Two very distinct types are recognized—grand mal and petit mal.

Grand Mal.—One of the most important of the symptoms of this disease, as far as diagnosis is concerned, is the presence of an aura. This aura is rarely absent and may be motor or sensory. Motor aura is evidenced by local spasm, which may affect the head, face, hands, leg, or, in fact, any portion of the body. Sensory aura is almost endless in its variety of sensations; it may remain local or be general, being referred to any portion of the body or referred to any of the special senses.

Whether the aura be motor or sensory, it has as its chief characteristic that in the same individual, over a protracted period, the same sensation or motor involvement persists. The aura itself lasts but a few seconds, but at times this period is long enough to warn the child of an impending convulsion.

Immediately following the aura the convulsion comes on. The head and eyes are usually turned to one side and the face becomes very pale. The eyes are then turned upward and the pupils always become dilated; usually markedly so. Coincident with these symptoms, or immediately following them, there is a violent tonic muscular spasm, one manifestation of which is the throwing of the patient violently to the ground, and usually the fall is a forward one. The violence of the fall is one of the chief features, for there is never a sinking of the body, as occurs in a faint. The rotation of the head to the side is usually persistent, but is not necessarily constant.

A cry which is inarticulate and hoarse, and never very loud, usually accompanies the first signs of spasm. From a sudden

paleness, the face rapidly assumes a markedly cyanotic appearance, owing to the tonic spasm of the respiratory musculature. During this first tonic spasm the tongue may be badly lacerated by the teeth.

All degrees of violence of the tonic spasm are encountered, but the foregoing description is of the average one, which lasts from three to thirty seconds. During this time the bowels and bladder are almost invariably evacuated, and this fact is of considerable diagnostic value.

Clonic spasms immediately follow the tonic spasm, and the symptoms are those of general convulsive seizure (see first portion of this section). The duration of this stage is from one minute to one-half hour (usually about three minutes), after which there is a somewhat gradual subsidence. The respirations become normal again and the cyanosis perfectly clears up. Consciousness is rapidly gained, as a rule, but not completely for some time, the child remaining dazed and quite oblivious to its surroundings or to what has gone before. Generally there follows a period of deep sleep, lasting for one or two hours, and awaking from which complaint is made often of severe headache and general malaise, which may last for several hours.

There is very little difficulty in diagnosing attacks of this kind—grand mal. The only probable confusion would seem to be that offered by hysteria, but in hysteria the warning cry is absent (or in the rare instances in which it is present, is very loud and more of a scream than a cry) and loss of consciousness is not absolute. The eyes stare, instead of being turned as in epilepsy, and there is no evacuation of the bowel. Evacuation of the bladder is also rare, but may occur as an incident in some seizures. The deep sleep following the attack is absent in hysteria.

Petit Mal.—These minor attacks present great difficulty in recognition, because of the almost endless variety of symptoms. It is needless to go into detail in regard to these, for there is absolutely nothing about them which is of diagnostic value. No matter what the variety, their most characteristic features are brief loss of consciousness and slight local convulsive movement. The loss of consciousness may be only momentary, the child recovering almost immediately, with a consciousness that a

period of unconsciousness has been present. Local convulsive movement may be so slight as to escape attention for a long time.

Both the unconsciousness and the local convulsive movement, no matter how slight they be, are diagnostic of this type of epilepsy, if they recur habitually. The whole attack is so transient that there is no time for the cry or fall, as in grand mal.

There is considerable difficulty encountered in the diagnosis of petit mal, because it is so extremely difficult to get a fair description of such attacks from the mother. There is a marked tendency to deceive in this matter, and parents will show great ingenuity in explaining what they call "spells." This makes it important that we inquire into the disposition of the child, since the advent of these "spells," for their habitual occurrence, associated with a change in temperament or the evidence of increasing irritability, is quite a strong point in diagnosis.

The organic type (Jacksonian epilepsy) is simply a peculiar type of epilepsy which has some distinctive manifestations which entitle it to separate consideration. It has as its essential pathologic condition some organic disease of the nervous system, which may be due to injury or not. The influence of heredity is also strong.

The onset is apt to be peculiar, in that after the aura (if there be one) some portion of the body is involved in an epileptic spasm. Usually the hand is the part affected, so that for a time the spasm is localized. It may then remain so, or immediately become diffuse, until almost all of the musculature is affected.

Consciousness is affected by the severity of the attack and also by the situation of the lesion, which is causative. This type usually begins before the tenth year of life. Even in the mildest of these cases well-marked mental impairment is the rule. Not uncommonly there is an associated speech disturbance and mild degrees of spastic palsy.

Of great interest and of some diagnostic value are some general considerations of epilepsy, regardless of the type. In the great majority of instances the fits occur during the daytime; in a much smaller number, at night. A very peculiar fact in regard to nocturnal fits is that if the child sleeps during the daytime, the

fit is apt to occur, so that there seems to be some condition induced by sleep which influences the occurrence of nocturnal fits.

Then there are several conditions which apparently modify the occurrence of the convulsions. Acute illness is the most important of these, for it is very noticeable that while the temperature is elevated, there is at least a diminution in the number and also the severity of the attacks, which may amount to complete subsidence. However, there are exceptions to this, and this is during the acute infectious fevers, when, instead of a modification, we are more likely to notice an increase.

Hysteria.—The hysterical convulsion is the most important of the motor manifestations of hysteria. It is not common in childhood, and the few instances in which it does occur are almost invariably limited to the period close to puberty.

The onset is usually predicted by several days in which psychic symptoms are prominent, and immediately preceding the onset there occurs a symptom group which is always peculiar to the individual. This group may consist of a sensation of suffocation, headache, abdominal distress or sinking feeling, tinnitus aurium, or, in fact, any of a number of such sensations. It is possible that the attack may be ushered in by a cry, but this is very rarely the case, and in the few instances in which it does occur it is very loud and more of a scream than a cry.

The convulsion is at first tonic and produces opisthotonos. This tonic spasm gives way to a clonic one, during which the body is tossed and jerked about somewhat violently by the muscular contractions. In from three to ten minutes relaxation follows, and may be ushered in by a light sleep which lasts but a few minutes. Awaking from this, the child is the subject of marked emotional excitement.

During this stage there is the evidence of conscious deception, and following this there may be delirium or semiconsciousness. In other cases the convulsion is followed simply by profound sleep which may last for hours, the child awaking with paralysis, contractures, or anesthesia of part or of all of the body. Throughout the whole attack the emotional element is marked and loss of consciousness is never profound. Incontinence is not apt to occur, and the tongue is not bitten, as in epilepsy.

The more common type of seizure is that in which there is a mild convulsive attack with partial loss of consciousness. The child may perform some special movement, or may imitate the actions of some animal, or may stand, lie, or sit in a fixed position, dazed and semiconscious. There may be localized spasm, and this may affect the diaphragm or the respiratory muscles or the esophagus. The emotional element is strong, however, even in these mild attacks.

SPASMS WITHOUT THE LOSS OF CONSCIOUSNESS

Tetany is characterized by tonic muscular contraction, which may be either continuous or intermittent. The musculature of the extremities is usually the most affected, both as to severity and frequency. The muscles of the neck, face, and trunk are not commonly involved in the spasm. Taken altogether, tetany is not a frequent occurrence during childhood, and when it does occur, it is often associated with laryngismus stridulus.

The development of the spasm may be very sudden, or, in other cases, be preceded by sensory disturbances. The chief characteristic of the disease is the symmetrical contraction of the hands and the fingers; the hand is flexed at the wrist, the thumb being turned into the palm of the hand and the other fingers extended; in the interphalangeal joints are flexed the metacarpophalangeal ones, while the little and the index fingers approximate each other. When the feet are affected, they are strongly extended, somewhat like a typical equino-varus; the first phalanges of the toes are flexed and the second and third rows are extended. The plantar surface is quite arched, the dorsum being prominent.

It is rare that the spasm of tetany affects more than the hands and the feet, but it may at times involve other parts. If forcible extension of the part involved in the spasm is attempted, considerable pain is caused.

The duration of the spasmodic condition is from a few hours to several days, and without any subsidence during sleep. During any of this period the spasm may relax more or less completely, but only to recur again. The period of relaxation is for a shorter time than the subsequent period of strong contraction.

There are three symptoms which are of considerable diagnostic import:

(*a*) Trousseau's symptom: This observer noted that in tetany an exaggeration of the spasm would occur when pressure was made upon the large nerve-trunks or upon the arteries of the extremities. All that it is necessary to do to bring it about is to constrict the shoulder with a twisted handkerchief or towel. The compression is best made during one of the periods of partial or complete relaxation.

(*b*) Chvostek's symptom: This is characterized by a spasm of the facial muscles when percussion is made over the facial nerve. Light percussion is all that is necessary.

(*c*) Erb's symptom: This is that there is a markedly increased excitability of the muscles to the electric current.

All these phenomena, due to the increased excitability of the peripheral nerves, may be observed not only during the period of marked spasm, but may persist for a long time after the contractions have disappeared. So long as there is such a persistence, it is evident that the little one is not thoroughly convalescent from the attack. Even when the excitability is removed, the danger of other succeeding attacks is not over until the underlying conditions of disease or malnutrition are corrected.

There are two etiologic factors which are prominent in tetany—age and rachitis. Tetany may occur at any age, but is most common in infancy, about 50 per cent. of the cases occurring during the first two years of life. Of the first two years, the first ten months show the largest number of cases, so that tetany is largely a disease of the first year of life. The reason for its common occurrence during this period is the prevalence of gastro-intestinal disorders, rachitis, and other forms of severe conditions of malnutrition.

What changes take place in the nervous system to produce this syndrome we do not know, but whatever they are, they are temporary, for the disease tends toward complete recovery. The influence of rachitis as an etiologic factor is marked; that is, there are more or less marked symptoms of rachitis found in nearly all of the cases of tetany in infancy. The rachitis which is associated with tetany is usually of a mild type.

The diagnosis does not present any difficulties, because of the typical symmetrical contractures and the periodic course of the disease. During the intervals of quiescence, use may be made of any or all of the three symptoms which have been already mentioned (Trousseau's, Chvostek's, and Erb's) to determine the existence of the disease. These same may also be of service in the detection of a latent tetany in an infant who is the subject of laryngismus stridulus.

The only difficulty of recognition might come with those rare cases in which the spasm involves the trunk, and under these circumstances tetanus might be suspected. In tetanus the musculature of the jaw is most prominently affected and is also the earliest part affected; then the neck muscles and those of the spine become subsequently involved, while the hands and feet are not affected with proportionate severity. In tetany the affection of the parts is quite opposite to that of tetanus, the contracture of the hands and feet predominating. Then, also, the contractions are not constant, but with periods of relaxation.

Chorea.—This is a syndrome which is evidenced by involuntary, inconstant, and incoördinate muscular contractions, involving some part or all of the voluntary musculature and occurring during waking moments only. Various causes have been assigned, heredity, reflex irritation, anemia, physical and mental exhaustion, and toxins being a few of the many. It seems quite plausible that it may be produced by many organic lesions of the nervous system, by toxins, and by nutritional changes and derangements of function of the cerebral cortex.

It is a well-established fact that at least one-fourth of all the cases of chorea are directly due to the poison of rheumatism. The percentage is much larger in many instances when we accept the observations of one man, but grouping the experience of a great many, there is no doubt whatsoever that at least 25 per cent. are due to rheumatism.

Chorea begins, as a rule, between the ages of nine and thirteen, and it is rare before the fourth year of life. A neurotic family history is common and females are affected about three times as frequently as males. Of the exciting causes, fright is a very important one; then come gastro-intestinal disease, intestinal

parasites, imitation, etc.; but whatever the exciting cause, there must of necessity be the predisposing conditions present of heredity, age, sex, etc., and the state of the blood.

Preceding the symptoms which are characteristic of the affection the child is anemic, nervous, and in a state of more or less malnutrition. The very first evidence of spasm may be in the clumsiness of the child in handling objects or in an inability to sit still. Such occurrences usually result in reproof, and the effort of the child to control the neurosis through the power of the will may result in a very transient period of repose, only to be followed by an exaggerated movement. Very soon muscular

Fig. 97.—Testing for chorea reflex. When articulation is attempted, there is a distinct tremor in the hands.

twitchings of the face, shoulder, or hand suggest that the child is not well.

During all of this early period some children are able to control the movements to a considerable degree, but the presence of muscular spasm may be detected by directing the child to perform some delicate task of muscular coördination, and to do this slowly. Such an act (like the threading of a fine needle) will bring out the fact that choreic movements are present. After the early symptoms merge into the more pronounced ones, there is probably no more clearly defined symptom group than chorea.

As a rule, the movements are mild at first, affecting but one member of the body or only a part of that member, then in a

short time extending until nearly the whole body may become involved and the movements be severe. Usually by the end of the second week the maximum of severity has been reached. The severity may be such that movement is constant and the body is twisted and distorted so that the child is not able to maintain an upright position. It is difficult to keep such children in bed, for the violent motion throws them about so that severe bruising may result. Between this severe type and the mildest cases there are all grades of severity. Usually the child is able to go about and has a limited control of the spasmodic movements, but all voluntary motion is accomplished by deliberate preparation and carried out with marked rapidity. Speech may be involved and the articulation is then jerky, or there may be a peculiar loss of control in the middle of a word. Choreic movements do not persist during sleep; that is, they may not cease absolutely, but they do subside markedly. Usually they cease entirely.

Any portion of the body may be involved, but the most frequently affected portions are the face, hands, and arms. Then they tend to become general, and in rare instances may be limited to one side of the body; but when they do, they do not differ in any particular from a general involvement.

Choreic children, as a rule, are somewhat precocious, but with very poor mental control; they are irritable, capricious, and are easily excited. This mental condition is usually associated with a weakened physical condition, so that the body does not keep up with the activity of the mind. The mental condition results finally in loss of memory to some extent, and there is a change in the child's disposition. This change in the mental condition and in the disposition may be added to by a moral dullness, so that the child is not responsible entirely for its acts.

In the severe types the musculature becomes exhausted by the constant movement and there is an apparent paralysis. But there is never a loss to electric reaction. Tendon reflexes are usually normal.

Reference must be made briefly to the associated anemia, for it must be correctly interpreted, indicating the marked nutritional changes. In all cases the heart must be thoroughly examined

and reëxamined, as the close association of cardiac lesions and chorea is marked.

The whole syndrome is so typical, when fairly well developed, that there is practically no chance for error in its recognition. Hysterical imitation might simulate it for a while, but in hysteria the movements are much slower and much more rhythmic in their character, and other stigmata of hysteria are present.

During nervousness and convulsive tic the movement occurs most during periods of rest and quiet, and there is an absolute absence of clumsiness during voluntary motion. The choreic movements which sometimes follow hemiplegia are very slow and very irregular movements on voluntary motion, but are not spasmodic, like chorea. In addition, one discovers some organic lesion with its history and symptoms to guide in a correct diagnosis.

The prognosis in chorea is good, mild cases recovering in three weeks, the average duration being ten weeks, and severe cases lasting for months.

Habit Spasm.—This is a pure neurosis, and the name was first applied by Gowers in describing sudden and rapid contractions of certain groups of muscles, which were but slightly noticeable at first, but which persisted until they became a habit. These movements are most common in the muscles of the face, neck, and shoulders. However, any part of the body may become affected.

There may be only the winking of an eye, the shrugging of the shoulder, facial grimaces of various kinds, or any one or several of an unlimited variety of movements. At first such movements are only frequent, then finally they may become almost continuous. The affected child is generally an active, restless, and nervous one. The spasms are exaggerated by conscious observation, so that it is a point in diagnosis to make the child fully aware that he is being watched; then, if the spasm is due to habit, it will increase in violence and frequency.

The cases are more severe and the worst cases are always seen during the latter part of the child's school term, whenever that may be. It is not uncommon to find hyperesthesia of some part of the head or neck associated with habit spasm. There is very apt to be a change from time to time in the situation of the spasm, the same part not being always affected.

The affection may continue for months or even for years. It is most common between the ages of seven and the period of puberty, and this is probably fully explained by one factor which is prominent at this period—school life. The general condition of the affected child is usually quite below normal, and there is generally a marked neurotic family history.

The only possible difficulty in the diagnosis would be that offered by chorea (and, unfortunately, some writers refer to this affection as habit-chorea), but the fact that it is limited to one group of muscles is characteristic.

Athetosis and Athetoid Movements.—These are a chronic form of spasm, in which the movements are slow, very irregular, and markedly incoördinate. As a general thing, the hand is the affected part, but there may be involvement of the face or the foot. They have been observed to occur in otherwise healthy children. Generally they are a sequel of the cerebral palsies. As there is no known treatment which is of the slightest avail, this may help to differentiate them.

Head Nodding; Rotary Spasm.—These are considered together, because in their etiology they are similar, and the only real difference is in the direction of the movements and the frequency. They are both rare forms of spasm and are observed almost exclusively during infancy. Of the two, head nodding is the rarer, and in this form of spasm the head moves with a vertical nodding motion.

Rotary spasm, the more frequent of the two, consists of a side-to-side movement of the head, which may be very rapid and almost continuous, but which in most instances is slow. No matter what the direction of the movement, it is usually rhythmic, and vertical and rotary movements may alternate. It is not uncommon for the movements to cease for a time while the infant's attention is closely fixed upon some object of interest, but this is not always so.

During sleep the movements cease entirely, and when the infant is free from excitement and in the prone position, all movement markedly subsides. It is common for nystagmus to be associated, but the eye movements are much more rapid than those of the head. The movements of the head and the eye do not correspond,

and any form of eye movement may be associated with any form of head movement.

The duration of the affection may be several months, and there is usually a steady improvement, even without any treatment. It rarely occurs after the first year of life, and then, only as it may be associated with organic disease of the nervous system, is it at all common during the second year.

Nystagmus.—This is a rhythmic, oscillatory, but entirely involuntary movement of one or both eyes, the movement being either from side to side or up and down. Nystagmus is always a sign of irritation, but this irritation may be general or local.

Fig. 98.—Examination of the eye. If the patient be a rebellious infant, perfect control may be secured if he is held firmly upon the nurse's lap, the child's head being steadied between the knees of the examiner while the examination is made.

Among the local causes may be mentioned: congenital cataract, corneal opacity, choroid or retinal disease, refractive errors of all degrees, and impairment of the normal vision from any cause.

Of the general causes, it most often depends upon some organic disease of the nervous system. However, in concussion of the brain it may be an accompaniment or a sequel, but in either instance we are not sure of the reason for its occurrence.

Hiccough.—This is a spasm of the diaphragm and is very frequently met with in all infants. Usually it is dependent upon some irritation of the digestive system, so that when it occurs with any regularity, the possibility of this as a cause should

be investigated. Most often the fault will be found in the frequency or rapidity of feeding, not in the composition of the food. In other instances it is directly traceable to other irritation, as a cold bath, excitement, especially that causing laughter, etc., but this form follows the causative factor quickly and is not habitual.

Occurring during the course of peritonitis or of intestinal obstruction, it is of very unfavorable import. Occurring in an older child and persisting, it is strongly indicative of hysteria or of a tendency to that condition. When it occurs during any prolonged or severe illness, it is indicative of a much lowered nerve tone, in which case it is of ill import, and of itself it is a very distressing symptom.

Congenital Myotonia.—This is a rare condition and is usually hereditary. It is characterized by inertia of the muscles, being sometimes confined to one group, or involving in other instances all the extremities. Although present at birth, it is exaggerated later on in life, and especially at and after puberty.

The characteristic feature of the disease is that after a period of repose, when an attempt is made to use the muscles affected, there is spasmodic rigidity which persists for a few minutes. The condition of the muscle is best described as inertia from slow initiative contractility and a delay in relaxation. There is tardiness in taking hold of anything and the same tardiness in letting go of the object.

In the attempt to rise the same thing is noticed, and as the child tries to sit down, there is a similar hesitancy. But all disability, no matter how marked at first, rapidly disappears under the influence of exercise. Mental excitation, on the other hand, tends to exaggerate the spasm. The affected muscles are larger than normal and are abnormally responsive to the electrical current.

The diagnosis of congenital myotonia from all other conditions of a spastic type of contracture is made by its characteristic disappearance during exercise and its reappearance after a period of rest. From physiologic myotonia neonatorum it is differentiated by the disappearance of the latter with the normal development of the infant. The tonic spasms of the newly born which occur at times under the influence of sudden change of temperature,

and which persist for only a few minutes, or at most a few hours, are all differentiated by their very transient course.

When the disease affects the lower limbs, as is usually the case, it may not be noticed until the child makes the attempt to walk, then the trouble becomes quite prominent. With a careful review of the history, it will generally be noted that the infant never used the limbs very freely.

Torticollis is considered in another section (see page 354).

Laryngismus stridulus and **spasm of the glottis** are considered in the section on "Laryngeal Stenosis" (see page 85).

Tetanus.—In spite of the fact that the tetanus bacilli are so common and the opportunity offered by the body for their entrance is so large, yet the total number of cases of infection is very small, and the reason is found in the biologico-chemical properties of the bacilli. Although there is but one recognized etiologic factor for all forms of tetanus, yet it is advisable, for clinical purposes, to recognize the two forms occurring during childhood—tetanus neonatorum and tetanus traumatica. The symptom-complex is similar in both types, so that one description answers for both.

The most prominent symptoms are those relating to the motor sphere; there is hardly a large muscle group in the body which escapes, although primarily and most severely the musculature of the head and neck is affected.

Some days after an injury (which may not have been noticed at the time or thought of since its infliction) there occurs an indefinite stiffness of the neck muscles and of those of the jaw. In the infant the result of the stiffness is an inability to nurse, with the consequent train of symptoms. The stiffness rapidly increases until the jaws are set and there is great difficulty in even partially opening them. The neck muscles are board-like in their tension, and the head is drawn backward. The face is set and the eyes are usually motionless, the alæ nasi widely dilated, and the mouth increased in breadth and drawn downward. There may be added to this a peculiar facial grimace which is not unlike a painful attempt to smile.

The muscles of the back and the abdomen are next involved, and when this occurs, the position of the whole body may be either

one of three—opisthotonos, emprosthotonos, or pleurothotonos. As a rule, the upper extremity is not affected.

When the disease continues, the legs, and especially at the knee-joint, become affected, but the feet and toes are generally spared. When the spasm becomes so general that it affects the muscles of the internal organs, the termination of the disease is usually and fortunately rapid. The diaphragm is generally markedly involved in the spasm.

When well developed, the slightest movement will bring on an exaggeration of the spasm of the already tense and board-like muscles. Even the entrance of some person into the room may be sufficient to bring this about, and so make the suffering of the child more excruciating. Almost without variation the spasms are tonic, in rare instances being clonic.

Cerebral symptoms are not apt to develop until near the time of death, when one may encounter delirium, but, unfortunately, in most of the cases the mind is clear. Perspiration is usually excessive and the tears flow freely and in great abundance.

The temperature is usually very high during the attack, and just before death occurs it may rise still higher, in some instances reaching 110° to 114° F. For one or two hours after death occurs the temperature may still be high.

With well-developed symptoms there could be but little chance for not clearly recognizing the disease. But not all of the cases are typical in their onset and development, and under these circumstances an error in diagnosis is not unusual during the developmental stage.

A contracture of the muscles about the jaw may be present in a more or less marked degree in several conditions affecting the jaw and the oral cavity. Some of these conditions are an abscess near the masseter, dentition occasionally, facial neuralgias of severe type, hysteria, follicular tonsillitis rarely, and meningitis.

It is not difficult to determine whether or not local conditions are responsible for a seeming trismus, and with such a determination there is usually a clearing up of all doubt as to the occurrence of tetanus. An examination of the mouth under any of the above-mentioned conditions might meet with considerable resistance, but this would not be so marked that it could not finally be overcome.

Of the general conditions which might lead to an error in the diagnosis, we have three—meningitis, hydrophobia, and strychnin poisoning.

In the first two of these, trismus is not a prominent feature and may be entirely absent. The cerebral symptoms of meningitis would serve to clearly distinguish it from tetanus, for in meningitis the mind is not clear, while in tetanus it is, until near the time of death.

The history and the characteristic features of hydrophobia are always sufficiently marked, so that none but the most superficial examination would allow of error.

In strychnin poisoning, there may or may not be a history of the ingestion of the drug, so that reliance must often be placed upon the other factors. It is especially true of strychnin poisoning that the spasms are most prominent in the extremities and this occurs very early. When trismus occurs at all, it occurs late.

Tetanus neonatorum does not differ greatly from the traumatic form, but the mode of infection is through the umbilicus. Its first appreciable appearance is usually at the end of the first or the beginning of the second week of life. It is quite well proved that there is a racial predisposition, for in the island of Jamaica and in Guiana from 10 to 25 per cent. of all the negro children born die of the disease. Usually the first warning of the occurrence of the disease is the inability of the infant to nurse. When the attempt is made to grasp the nipple, it is suddenly released with a sharp cry, and this is the earliest evidence which we have of involvement of the masseter in spasm. Following this first indication there is apparently no difference in the development of the disease.

Facial tetanus is a form of the disease which is so pronounced that it deserves some passing consideration. Its main characteristic is that one is not dealing with spasms of distinct groups of muscles only, but, along with them or preceding them, there is paralysis of the facial nerve. It usually follows head injuries.

Strychnin Poisoning.—Poisoning by strychnin is sometimes accompanied by spasms which are quite similar to those of tetanus. It is not so much in the type of spasm as in the location of the same that there is a difference. The spasm of strychnin poisoning seems to spend most of its force in the muscles of the ex-

tremities. Trismus is never an early symptom, as it is in tetanus, and it may not occur at all. The contracture of the muscle in tetanus never completely subsides; it does have a period in which there is a partial relaxation, but this is never complete. In strychnin poisoning there are definite periods during which there is a perfect relaxation.

The history of the ingestion of the drug is valuable only if it is clearly obtained; the denial of such ingestion should have little weight if the other symptoms are suspicious.

RIGIDITY OF THE NECK MUSCLES

A contracture of the muscles of the neck which results in a stiffening of that part of the body, or which may be severe enough to result in complete immobility of the neck, is not infrequent during childhood. The degrees of the contracture vary within wide limits, the slightest degree being that in which the head is extended and passive motion is rebelled against, but at the same time the head is not thrown out of its natural position. In this form every attempt at enforced movement is accompanied by evident pain, at which the little one very naturally rebels. It is a simple matter to test the presence of the condition, for even with the mildest type of contracture, if the child is recumbent and an attempt is made to bring the head forward, there is pain, while in a normal condition there is no difficulty (and certainly no pain) in the procedure.

If a contracture of this mild degree occurs in the course of meningitis and the child is somnolent, the effort to bring the head forward is difficult and the child gives evidence of pain. In the more severe degree the head is drawn and fixed to one side or may be forcibly drawn backward.

When one considers the diagnostic value of this form of contracture, it is advisable to distinguish between the acute form and the chronic.

Acute Forms of Contracture.—The acute forms are most commonly associated with the different forms of meningitis, and the origin of such contracture is undoubtedly due to a tonic spasm of the musculature of the nape of the neck, which, in turn, is caused by an irritation of the anterior cervical nerve-roots.

The presence of backward contracture is usually first evidenced by the marked hollow which is present in the pillow upon which the child's head has rested. Children often assume apparently uncomfortable positions, and it is common to observe them with the head drawn back, but there is not the hollowing out of the pillow unless the contracture is persistent. Of all forms of meningitis, contracture of the neck muscles is the earliest and most constant

in epidemic cerebrospinal meningitis. No matter how slight the effort to bring the head forward, the child rebels, and if the act is persisted in, there is unmistakable evidence of pain. At the same time if rotary or posterior movements are attempted, there is no evidence of pain being caused. As the musculature is palpated, it is observed to be hard and unyielding.

The symptom is so early and so constant in the epidemic form of meningitis that if it is unmistakably present in a child who has been ill for thirty-six hours or less with symptoms of high fever and intense headache, and these have been present from the onset, the diagnosis of epidemic cerebrospinal meningitis is probable without further symptoms. If there is associated with these symptoms a marked pain in the back, which is more marked when a change is made from the prone to the upright position, the diagnosis is almost certain. One must be positive, however, that the child was well for some days previously, and that the onset was sudden with all symptoms severe from the very first.

On the other hand, if the onset of the symptoms was apparently sudden, with an illness of a few days preceding, in which there was vomiting which was persistent and without apparent cause, and associated with slight fever and perhaps constipation, then the evidence would strongly favor a diagnosis of tuberculous meningitis.

During the course of meningitis, if there has been a contracture of the musculature of the neck and coma supervenes with a considerable degree of relaxation of the muscles, it is a sign of grave import, indicating an early fatal result.

When a contracture of the musculature of the neck occurs during the second week of an illness in which there has been a decided elevation of the temperature without persistent vomiting, then a diagnosis of some form of meningitis would be doubtful, even though the child was in a state of delirium or of somnolence. Such a condition would be much more suggestive of relapsing fever or of a serious typhoid. By the second week in either disease there would more than likely be present other corroborative signs.

The retraction of the head which is associated with general muscular spasms, as is observed in cases of tetanus and in poisoning

from strychnin, are both considered under another heading (see "Convulsions").

Torticollis.—This is generally produced by the contraction of one sternomastoid muscle, and associated with it there is usually some spasm of the posterior cervical muscles and the trapezius. There are various degrees of deformity, depending upon the number of involved muscles and the extent of the involvement, so that in the mild cases there is an inclination of the head toward one side and a slight rotation toward the opposite side, while, when severe, the deformity is exaggerated and the head is held immobile. Modifications of these are observed as other muscles are affected, and if the trapezius is much affected, there is less rotation, but more inclination to the side and backward and the shoulder is raised.

With an affection of both sides the head is drawn forcibly backward, and without rotation to the side, and it is held rigidly in that position. When the case is recent, there are usually localized pain and tenderness, and passive motion will overcome the contracture, in part at least. The condition may be congenital, and as such the cause is a subject of much dispute. It is not necessary to go into this discussion here, for until we have further definite knowledge, we must consider such cases as we do other malformations.

Of the acute acquired forms, the most frequent cause is an irritation of the spinal accessory nerve from an enlarged cervical gland. During the acute infectious diseases these glands are commonly enlarged, and this is the explanation of the occurrence of torticollis during the course of these diseases.

An exposure to direct draft may result in temporary stiffness. Sometimes torticollis is associated with acute or with phlegmonous tonsillitis and with retropharyngeal lymphadenitis, but it is far from being a common occurrence in the course of these affections. The pain is out of proportion to the amount of contracture when rheumatism is the cause, as it is very frequently in childhood. Torticollis of an acute form is sometimes observed as one of the many manifestations of hysteria, but it is not common, and the other evidences of hysteria are so pronounced as to allow of no error as to the cause.

Chronic Forms of Contracture.—When one encounters a

chronic and persistent contracture of the neck musculature in children, the cause is almost invariably found to be spondylitis. It is rare that the contracture is of the severe form, being in most instances that in which the head is simply extended, but with no retraction. In many instances the posterior muscles are the ones which are the first affected, but when the lateral muscles become involved, then the head is drawn to one side and we have a chronic torticollis.

It is not unusual (in fact, when watched for, it is found to be common) for a chronic state of contracture of the neck muscles to exist for several weeks as the first and only prominent sign of cervical spondylitis. Sometimes the other symptoms are so indefinite that they are practically valueless in diagnosis, so that if one observes a chronic contracture which has no discoverable cause, then one is justified in making the diagnosis of cervical spondylitis, even in the absence of other symptoms.

One must always be guarded, however, against mistaking a form of contracture which is at first apparently chronic, but which upon investigation shows a distinctly periodic character, and which is due to malarial infection. The periodicity of such a condition and its disappearance under the appropriate treatment would clear up the diagnosis.

The influence which severe burns have in simulating torticollis or rigidity of the neck musculature need only be mentioned, as the mistake of the true condition (of skin contracture) is only possible by the most superficial examination.

PARALYSIS

Paralysis is a partial or complete loss of voluntary motion. Paralysis may exist if the loss of power is due to some disease of the muscle itself, or of the nerve influence which controls it. Inhibition of the muscular function produced by disease which causes pain upon motion is sometimes called "false paralysis," but it is by no means a paralysis, and care must be taken not to mistake it for such.

According to the part which is affected, paralysis is classified as follows:

Monoplegia: when one extremity is involved.

Paraplegia: when two symmetrical extremities suffer loss of power.

(*a*) Paraplegia cruralis: both legs involved.

(*b*) Paraplegia brachialis: when both arms are affected.

Diplegia: when two extremities are affected, but not symmetrical ones.

Hemiplegia: one side of the body is affected.

Crossed paralysis: when one side of the face and the opposite side of the body are involved.

Local: when small groups of muscles evidence a loss of power.

Multiple: when several parts are involved at one time.

There is a still further division which depends upon the cause, as cerebral, spinal, neural, muscular, functional paralysis, and pseudoparalysis.

According to the type of the paralysis, we have spastic paralysis (evidenced by an increase in the muscular tone, an exaggeration of the reflexes, and the subsequent liability to the occurrence of contractures) and flaccid paralysis (in which the muscular tone is diminished, reflexes decreased or abolished, and with no resistance to passive motion).

In childhood it is usually possible to assign any paralysis to one of two types—either the cerebral or the spinal.

Cerebral paralysis is chiefly characterized by a spastic condition

of the musculature affected, by hemiplegia, exaggerated reflexes, and no change in electrical reaction. As a remote feature there is little or no atrophy of the muscles affected by the paralysis.

Spinal paralysis is characterized by flaccidity of the muscles, paraplegia, diminished reflexes, and a decreased reaction to electrical stimulation. As a remote feature there is more or less wasting of the muscles affected.

For the purposes of diagnosis in the paralysis of childhood these two latter divisions (cerebral, spinal) are most important. Before one can proceed to an intelligent understanding of the diseases which are responsible for the occurrence of paralysis, one must

Fig. 99.—Testing the knee-jerk. Whenever possible, the stroke should be made with a percussion hammer.

determine beyond any doubt the condition of the muscles, whether spastic or flaccid. If there is a flaccidity of the muscles involved, we think first, but not finally, of a spinal origin; if there is spasticity, then the suspicion is of a cerebral cause.

Spastic paralysis must not, however, be mistaken for the contractures which are observed after degeneration of the muscles, as is seen in infantile paralysis, neuritis, etc. In these instances there is a permanent flexion, and the resistance to passive motion is not because of an increased muscular tone, but is due to actual change in the structure of the muscle.

Monoplegia may be closely simulated by immobility of the limb,

which is entirely dependent upon the fear of pain which is caused by motion, or to an immobility from epiphyseal separation. In an older child pain would be complained of, but in a nursling it always seems easy for the parent to mislead by careless statement. Irrespective of the history, an examination including passive motion would determine the difference. With epiphyseal separation there is more or less crepitation and an enlargement at the ends of the long bones.

As the observance of the condition of the muscle is so important, it may be well to define briefly what is meant by muscular tone. Muscular tone means that condition of the voluntary musculature by which there is maintained a sufficient degree of tension to enable the muscles promptly to respond to nervous innervation. Naturally, this tone varies under normal conditions, but only to a slight degree. Under the influence of fatigue, anemia, malnutrition, or any condition which tends to exhaust the system, there is a lessened tone. The best test to determine muscular tone is the amount of resistance offered to passive motion. The limb is grasped firmly and suddenly flexed, and if the normal tone is present, there is a very transient involuntary resistance, which rapidly disappears, so that the limb may be freely moved with but slight effort. Such a test requires the coöperation of the patient; that is, there must not be resistance to the procedure, so that it is only adaptable for use in older children who are not fearful of the manipulator. Sometimes in younger children, by trying to make the desired motions as if in play, so as to gain the confidence of the child, and then suddenly diverting its attention, the test can be made satisfactorily.

PARALYSIS IN WHICH THE MARKED FEATURE IS MUSCULAR FLACCIDITY

When the flaccid condition of the musculature has been determined beyond all doubt, the next consideration will be to bring out the fact as to whether the paralysis had an acute or a gradual onset. This is generally determined by the history of the case. The question to be decided is, "Did the paralysis follow a recent illness of a more or less severe type, or is the present condition one

which has occurred during or following an illness or an indisposition of long standing?"

Infantile Spinal Paralysis.—The diagnosis of this disease cannot be positively made until the time that the paralysis occurs. If prodromal symptoms are present, they are not distinctive or even suggestive, so that the occurrence of paralysis comes usually as a complete surprise. The paralysis is at first noticed in one or more of the extremities, and the instances in which one lower extremity is involved largely predominate. The cases in which one or both lower extremities are affected constitute about two-thirds of all of the cases. The diaphragm, the muscles of respiration, and the sphincters almost invariably escape, no matter what the extent of the distribution of the paralysis.

The most frequent period of development is during the second year of life, and four-fifths of all the cases are manifested before the third year is ended. After the sixth year it is of rare occurrence.

The cause of the disease is as yet unknown, and, like all diseases in which the etiology is obscure, many and widely varying causes are assigned by different authors. However, when one finds he is dealing with a disease which occurs in otherwise healthy children, almost invariably during the heated term, and generally with prodromal symptoms of fever, and sometimes of pain, the natural thing to think of as a cause is some toxic condition with a local lesion, or some infection which results in infectious embolism or thrombosis.

The mode of onset varies. In a large majority of instances there are some malaise, high temperature, vomiting, and sometimes more or less pain in the limbs. There may also be a general hyperesthesia, but, taken altogether, there is nothing definite about the onset. Such symptoms may persist for from one to four days before the occurrence of paralysis.

In a still smaller number of cases the child retires in apparent health, and upon awaking in the morning it is found that one or more of the limbs are in a state of flaccid paralysis. In such cases there is no pain. The smallest number of cases are those which follow some injury or fall, and in these instances the paralysis may be almost immediate or may not appear for twenty-four hours or more.

A difficulty in diagnosis is encountered right at this stage, for there is nothing in the prodromal symptoms to arouse a suspicion of the disease, and so other diseases will be mistaken for it, either through haste in arriving at a conclusion or through too much regard for the prodromal symptoms. The onset of one of the acute infectious diseases, disease of the joint, rheumatism, and many other conditions will be diagnosed as a result of the early symptoms, and it is only with the occurrence of the paralysis that the diagnosis is positively made.

No matter what the type of the prodromal symptoms, the occurrence of the paralysis is rapid. Within the first twenty-four hours the maximum has usually been reached, but this may at times be delayed until five or six days have passed, so that it is not well to prognosticate as to the extent of the paralysis until that time has elapsed.

Then follows a period of from one to five weeks during which there is no apparent change in the condition of the paralyzed parts. The affected part is unusually flaccid, and this is usually not accompanied by any pain or discomfort. The paralyzed limb is cold and cyanotic, but there is no persistent sensory impairment. If slight anesthesia be present at first, it quickly passes away. After this period of apparent unchangeableness, spontaneous improvement occurs, and this may involve the whole of the limb or only a portion of it.

It is generally recognized that the paralysis at first is always more severe and extensive than it is later on. The acute process seems temporarily to overwhelm certain structures, and as soon as there is a subsidence of the acute process, most of the impaired structures resume their function. The improvement almost always begins in the muscles which were last affected. The period of spontaneous improvement may last for three months.

The next change is a very noticeable muscular atrophy. The affected limb is smaller than the corresponding one, and this change may be noted in a few cases as early as two weeks after the onset of the paralysis, but generally its occurrence is not until seven or eight weeks have elapsed. There is an arrested development of the whole of the affected limb, so that it remains smaller and shorter than its fellow.

The circulation in the limb is poor, so that it is cold, blue, and dead-looking. Under these conditions one would naturally expect the occurrence of bed-sores, and it may be helpful to remember that these never occur.

As the paralysis is not permanently localized in all the muscles of the limb, but in some only, contractures are established because of the unantagonized contraction of the healthy muscles. This results in various forms of talipes. The extensors usually suffer more severely than the flexors, and in many instances the extensors are the only muscles affected. If the affected muscles are tested at this stage by the faradic current, there is found to be either complete absence or much diminished response. The galvanic reaction usually persists, and there may be an altered polar reaction.

During the acute stage bronchitis is a common complication and may be very serious. During the later stages there is one rare complication which ought to be kept in mind; that is, a chronic degeneration of anterior horn cells (with subsequent atrophy of the muscles), which is superimposed upon a cord which has been injured earlier in life by infantile spinal paralysis.

The diagnosis does not present very many difficulties in most of the cases. The difficulties of diagnosis at the onset, while only the prodromal symptoms are present, and the liability of mistaking other conditions, have already been referred to. When the paralysis is limited to one limb, there is the possibility of mistaking some joint disease, and an early diagnosis may be very difficult. There is so much difficulty encountered during childhood in making tests by electricity that this means of differentiation is much lessened in value.

It is not always easy to make a clear distinction at first between infantile spinal paralysis and that analogous affection, infantile hemiplegia. There are many points of similarity between the two diseases:

(*a*) Both affect children of the same ages (usually before the end of the third year and very rarely after the sixth year).

(*b*) The cause of the paralysis is unrecognized.

(*c*) The mode of onset is quite similar, in that paralysis quickly follows a few hours, or at most a few days, after some indefinite

illness in which there may be high temperature, convulsions, vomiting, etc.

(*d*) The paralysis (the first positive symptom) in both diseases may become localized in an entire limb or be confined to some of the muscles of that member.

(*e*) The sphincters are not involved, neither is sensation, unless transiently.

The differences are as marked, however, as are the similarities. Cerebral paralysis is unilateral, and the usual form is hemiplegia. If but one extremity is affected, by a preponderating preference it is the arm; if two extremities, then it is the arm and the leg of the same side. In the spinal type the most frequent involvement is first one leg, and, if more extensive, then two legs.

In cerebral paralysis there is an absence of any electrical change in the affected muscles, but, as has been stated before, this is difficult usually to demonstrate. In the cerebral type the reflexes are exaggerated, while in the spinal they are absent or much diminished.

After a case of infantile spinal paralysis has persisted for a long time, that is, until such time as the paralyzed musculature begins to show atrophic changes, it may readily be mistaken for one of the following conditions: muscular dystrophy, multiple neuritis, acute transverse myelitis, pseudoparalysis of scurvy or rachitis, and paralysis following acute meningitis.

The distinction from muscular dystrophy is usually easy, for the history is so entirely different, but there are instances where it is impossible to obtain by any means a clear history of the sudden appearance of symptoms. Then the facts to be considered most carefully are that in muscular dystrophy all the limbs are usually affected, and if it is of the pseudohypertrophic type, certain muscles are enlarged.

There is not the coldness and the cyanotic appearance of the affected limbs which is so common in infantile spinal paralysis.

Multiple neuritis is generally distinguished by its gradual onset and by the presence, more or less prominently, of sensory symptoms, as pain (which is generally along the course of the affected nerve) and alterations in the sense of touch, temperature, and muscular sense (all of which are difficult to test in a young child). Be-

sides this, there is often a history of antecedent diphtheria, and spontaneous recovery takes place in from two to three months.

Sometimes the onset of multiple neuritis is sudden, with febrile symptoms and an early paralysis, and the sensory symptoms not at all marked; under these circumstances it is almost impossible to make a differential diagnosis. The course of the disease is the main point upon which one can depend.

Acute transverse myelitis at the onset may simulate infantile spinal paralysis, but in the former there are decided anesthesia, exaggerated knee-jerk, ankle-clonus, and, what is quite distinct from infantile spinal paralysis, there is generally an involvement of the sphincters.

In addition, there is a tendency to the development of bed-sores, slight wasting, and the reflexes at the level of the lesion are lost, but below it they are exaggerated. The main point, however, is that anesthesia develops simultaneously with paraplegia. Besides this the disease is very rare.

Pseudoparalysis of scurvy or rachitis is a condition which must be considered, for several times the diagnosis has been made of paralysis when scurvy was present. The pain in the limbs, the extreme wasting of the muscles, and the general indefiniteness of many of the symptoms make the differentiation sometimes difficult.

There should always be a search made for associated symptoms of scurvy, and the gums will give valuable evidence, especially if teeth are present. The spongy gums, the pain upon motion (especially about the knees), and the general tenderness and hyperesthesia all tend to exclude the spinal disease.

The muscular weakness of rachitis is sometimes mistaken for flaccid paralysis, but the electric reactions are normal, the symptoms are always bilateral, and other evidences of rachitis are present.

Acute meningitis may be followed by paralysis with flaccidity and atrophy, and if seen at this stage, may simulate somewhat infantile spinal paralysis. The paralysis is, however, always preceded by signs of irritation, and the sensory symptoms are usually marked. Pain is severe and increased by motion or pressure. The history would aid at once in excluding the possibility of anything but meningitis as the cause.

Multiple Neuritis.—The chief etiologic factor in children is diphtheria, although it is occasionally a sequel of other diseases of an infectious type, and particularly scarlet fever, malaria, typhoid, and rubeola. In all probability the inflammation depends upon direct action upon the structure of the nerves by the toxins. The etiologic factor determines to an extent the variety of the symptoms, for when following diphtheria, the soft palate is generally involved.

The onset of the disease is gradual, and it is usually from two to four weeks before the paralysis has reached its maximum of intensity. Even in those rare instances in which there is an abrupt onset, several days always elapse before the appearance of the paralysis. One marked characteristic of the disease is that both motor and sensory symptoms are present and are the same in their distribution. The first symptom noted is generally a weakness of the muscles which later on will be the seat of the paralysis, and this weakness is gradual in its development until there is a complete paralysis.

The paralysis may be confined to a few muscles in the extremities, or may affect all four limbs. In rare instances there is an extension to the muscles of the trunk and neck. The sphincters are free from any involvement.

The weakness of the muscles which is an early symptom may be evidenced by the child being unable to use the muscles accurately. This may show itself most prominently in clumsiness in handling articles or in stumbling. In other cases there may be an inability to sit erect for any length of time, and in very young infants all that may be noticed may be irritability at being handled at any time. As the muscles of the hands and the feet are the most frequently affected, and the extensors particularly, there is often wrist-drop and ankle-drop.

While the paralysis is increasing, the sensory symptoms begin to show themselves, and they are not prominent at any other time after this. The chief of these are pain and tenderness. This is usually most marked along the course of the affected nerve, and is followed by anesthesia of the affected areas. The pain is difficult to demonstrate accurately in the young infant, but in older children it is observed to be clearly neuralgic in type and is in-

creased by pressure either over the nerve or the affected muscles.

In from three to five weeks the anesthesia which has followed the early pain and hyperesthesia begins to show a slow but gradual improvement until there is complete recovery. If the child is old enough and of sufficient intelligence to aid in the tests, it will be found that the sense of touch, temperature, and the muscular sense are all about equally affected. Tests by the use of the electric current are not of much diagnostic value, as they are not distinctive, but they may be of prognostic import.

Ataxia, tremor, edema, etc., may all be present, but they are far from being constant features and have no diagnostic import. Permanent flaccid paralysis sometimes persists in some member, associated with reaction of degeneration.

The diagnostic features of multiple neuritis are the combination of motor and sensory symptoms with similar distribution, diminution in electric response, atrophy, gradual onset, and wide-spread paralysis. When we find in a child that all four of the limbs are paralyzed, it is very suggestive of the disease, and if, in addition, the muscles of the spine and of the neck are involved, it is almost positive evidence. That the paralysis affects remote parts and is often incomplete is also suggestive.

The diagnosis from infantile spinal paralysis may at times be difficult, because there is some apparent similarity in the etiology, and the paralysis in both instances has the properties of the peripheral type; that is, the response to the electric currents rapidly fails in the affected nerves and muscles, may be abolished, and the reaction of degeneration appear. The type of paralysis is also similar in that there is flaccidity followed by atrophy, with much diminished or lost reflexes, and the sphincters are not involved in either disease.

However, there are marked differences also; the mode of onset is almost always different, being very gradual in multiple neuritis and accompanied with pain and other sensory symptoms. The pain is usually a very early and usually severe symptom. There are occasional instances in which multiple neuritis has a sudden onset with fever, early paralysis, and few marked sensory symp-

toms, and in these cases the diagnosis from infantile spinal paralysis is only made by a study of the whole course of the disease.

The spread of the paralysis is generally quite different in the two diseases; in infantile spinal paralysis a large muscle group is affected at the onset, with a gradual improvement later on, while in multiple neuritis the paralysis is apt to be slight at first with gradual extension until large groups of muscles are involved. Over the affected areas of neuritis, if there is any change, it is a vasomotor one (there may be edema), but in the spinal disease there are coldness and cyanosis.

Compression myelitis develops atypically at times, so that there may be a reasonable doubt for a while as to whether we are dealing with this disease or with multiple neuritis. The former may show other symptoms before the deformity or any other objective symptoms of bone disease. The pain is radiating, there is stiffness of the spine in walking, and the loss of power is gradual. Increased reflexes and ankle-clonus are generally present and quite characteristic. Spinal caries should be suspected in every instance where the symptoms indicate transverse myelitis which has no apparently definite cause.

Obstetric and all other forms of traumatic neuritis exhibit asymmetry, and it is not difficult to determine a sufficient cause for the condition.

Transverse myelitis sometimes is manifested by a rapidly developing flaccid paralysis. In the musculature so affected there may be a decided diminution in the response to the electric current. Not only this, but there may also be the presence of the reaction of degeneration and diminution or loss of the reflexes. If there is an overestimation of the importance of these symptoms and a disregard for the importance of a full clinical picture, a mistake might readily occur, and the disease would for a time be considered infantile spinal paralysis. With a detailed examination the differences would at once be evident, for in transverse myelitis anesthesia is produced simultaneously with paraplegia, the two occurring at the same time whether they are complete or incomplete. Both the sensory symptoms and the motor ones are below the site of the lesion; reflexes at the level of the lesion being lost, and below that exaggerated. The sphincters are involved.

Acute Meningitis.—This disease may occur and, following the attack, there may be at times a paralysis with flaccidity and subsequent atrophy. Coincident with the paralysis there is generally some anesthesia. The paralysis is always preceded by symptoms of irritation and the pain is usually very severe, being increased by the slightest motion or by pressure over the spine. Contractures of the muscles of the occiput and spine usually follow the foregoing symptoms, and then finally the flaccid paralysis supervenes. Such a history would exclude the possibility of any other disease being the cause of the paralysis.

Infantile Cerebral Paralysis (Antenatal Form).—In some of the cases of the antenatal form of infantile cerebral paralysis, instead of the rigidity which is so characteristic of the other forms of cerebral paralysis, there may be a flaccidity of the musculature. It is an unusual occurrence, and therefore must be remembered, otherwise it would lead to considerable difficulty in definite diagnosis.

In this class of cases the loss of power is usually not the most prominent symptom, so that the character of the paralysis need not be given so much thought as the other symptoms, and especially those which refer to the mental condition of the infant.

Acute Ascending Paralysis—Landry's Paralysis.—This is a very rare disease of early life with an obscure etiology. It is evidenced by the occurrence of paralysis of a flaccid character, which may be preceded by mild and indefinite symptoms. The legs are first affected, then follows an extension upward, involving successively every part of the body. The development is rapid (twenty-four to forty-eight hours), as a rule, but may take two weeks. Hyperesthesia is followed by anesthesia and loss of reflexes, but there is no change in electric reaction. No atrophy or involvement of the sphincters occurs. Death occurs in one week, as a rule; if recovery, it is after about three months' illness.

Diphtheritic Paralysis.—This is not alone the most frequent form of multiple neuritis, but there are present peculiar features which entitle it to a special consideration.

If lassitude and malaise occur in a patient who has been suffering from diphtheria, it should at once excite suspicion, and this would be much strengthened if upon examination albuminuria

was discovered. The absence of knee-jerk would still add to the evidence, and if the symptoms of nasal voice and the regurgitation of liquids through the nose are present, they are almost pathognomonic.

The time at which the symptoms of paralysis make their appearance varies to a considerable extent. Symptoms may appear while the local lesion is still present, but this is unusual. On the other hand, they may be delayed until the tenth week after the lesion has disappeared; but this is also uncommon, and the average time is from three to four weeks.

It is very common to observe a short period of three to seven days during which the child suffers from a more or less marked lassitude and malaise, and this precedes the occurrence of paralysis. It is frequently of service in giving warning of an impending paralysis. Closely following this there is a change in the voice, which becomes nasal, and is due to paralysis of the palate. At this time, if care is taken to observe it, there will in nearly every instance be found some weakness and tingling in the extremities, and especially in the legs.

The knee-jerk is usually absent, and this is a most significant symptom, but the presence of knee-jerk, even with increased activity, does not exclude the diagnosis. Regurgitation of fluids through the nose is a very common occurrence, and in most instances this will be the first thing which will command the attention of the parents. The paralysis may involve the palate alone, or the musculature of the pharynx and larynx in addition.

Besides the few cases in which the paralysis is actually limited to the throat, there are a larger number in which it is apparently so limited. I use the word "apparently" because a careful search will reveal evidences of paralysis elsewhere, although not marked enough to be determined without careful examination.

After that of the throat, the next superadded paralysis is generally that of the legs, and the symptoms of paralysis in the extremities or in the trunk do not differ in any way from those which are due to multiple neuritis from other causes, except the absence of much pain. Associated with the involvement of the

legs there is generally an inability to use the eyes for any close work, owing to an involvement of the ciliary muscle.

When the limbs are paralyzed, it is not complete, but is to such an extent that the symptoms to which it gives rise are those of muscular weakness with more or less flabbiness. There are no well-defined atrophies nor is there any pain (anesthesia is the rule) in the course of the affected nerve.

At times there is a further involvement of the eye muscles, usually the external recti. If the third nerve muscles become involved, as is occasionally the case, then there may be a troublesome diplopia. When the upper extremities are involved in the paralysis, it is of serious import, such cases usually dying from cardiac paralysis. When recovery takes place from the paralysis, it is complete.

I have thought it well to leave the consideration of other features of the paralysis until this time, for they are of peculiar importance; these features are the involvement of the respiratory muscles and of the heart.

Respiration paralysis may occur as a result of involvement of the phrenic or the intercostal nerves. The first warning is usually given by the occurrence of an attack of dyspnea which may be accompanied by a toneless cough. These attacks are generally repeated, and as time goes on they increase in severity and sometimes in frequency. The breathing may be entirely thoracic on account of the involvement of the diaphragm, and the respirations are rapid, shallow, irregular, and evidently ineffectual. During these attacks, which are paroxysmal, the suffering of the child may be intense on account of the fear of immediate suffocation. If during these attacks there is the occurrence of vomiting, abdominal pain, and disturbance of the action of the heart, the case is practically hopeless.

The symptoms which first lead to a suspicion of cardiac involvement are irregular and intermittent pulse. As the symptoms increase in severity there are usually added pallor, restlessness, precordial distress, and coldness of the extremities. Within twenty-four hours after the first appearance of such symptoms death may take place.

In other instances, which are in the minority, there is no appre-

ciable warning of impending trouble, but after some unusual exertion a sudden paralysis of the heart occurs. The apparently well-marked crises which occur are nothing more or less than acute exacerbations of symptoms and conditions already present. Such exacerbations may last three minutes or be prolonged for several hours, and recurrences are the rule. Where death occurs from cardiac paralysis without warning and after a muscular effort, it is probably the heart muscle itself which is at fault, or there may be an associated toxic myocarditis.

The diagnosis of this disease does not present any difficulties unless there is an absence of a history of a preceding diphtheria. In the presence of a paralysis of this type the history of even a mild attack of sore throat should arouse suspicion, for frequently such cases occur and the child has never been ill enough to take to its bed. While the faucial type of the disease (diphtheria) is the most common, it must not be forgotten that paralysis may just as readily follow diphtheria in other situations.

The features which make the diagnosis most positive are the history of a preceding diphtheria, an involvement of the ciliary muscles, and an associated weakness of the limbs (especially the lower ones), and change in the voice, no matter how slight.

Chorea.—This disease often has associated with it a paralysis which is partial and has flaccidity as a marked feature. Usually, when the paralysis is noticeable, it is evidenced by a decrease in the power upon both sides, and this is most noticeable in the limbs which are most affected by the choreic movements. More severe forms than this may occur and be localized; in the order of their frequency they are as follows: brachial, hemiparesis, and paraparesis.

The paralysis is of early occurrence, following very shortly after the beginning of the choreic movements. Usually the first thing noticed is that the movements on one side of the body are very much lessened, and this is generally attributed to some general improvement of the child, but it should always arouse a suspicion of an impending paralysis. When a general improvement of the case is taking place, the lessened movement is general and not one-sided.

Very soon after the event of lessened movement the arm

usually becomes almost if not completely helpless, and in walking the foot is dragged perceptibly. The paralysis of the arm may remain practically complete for a few hours, but after that the paralysis is never totally complete. The marked tendency is toward recurrences with successive attacks of chorea, but the type of paralysis is not the same in succeeding attacks.

It is a very unusual happening for the paralysis to appear after the choreic movements have ceased, and yet in some instances this does occur. The usual course is for the two to disappear together, but in the few instances the paralysis may persist longer than the spasm.

Chorea nollis is a much more severe type of paralysis than that just described; in this type the paralysis develops within twenty-four to forty-eight hours and involves the greater portion of the body. There is a complete flaccidity, but the choreic movement never entirely ceases; it may be so slight as to need careful examination to detect it, but it persists usually in the hand or the face.

Now, in neither type of the paralysis is there any change in the cutaneous sensibility, and the electric reactions are unaltered. Even with a persistent paralysis there is never an atrophic change. The duration of choreic paralysis is from fourteen days to six months. A common chorea is rare under the age of five years; paretic chorea is most frequent at that age, so that this point may be helpful in the diagnosis.

The paresis of chorea is in itself quite characteristic (excepting chorea nollis), having a somewhat gradual onset and an incomplete paralysis of a flaccid type, in which the arm is much more affected than the leg, and the hand much more than the shoulder. In addition, there is no muscle-wasting or any pain.

The diagnosis is somewhat simplified, for all cases of paralysis of sudden involvement (that is, less than twenty-four hours) can be excluded as being paretic chorea. Given a child between the ages of five and twelve with a gradually appearing paralysis of one arm or of one side, the probability of such a paralysis being choreic is almost a certainty.

Hysterical chorea offers the greatest difficulty in the diagnosis when paralysis is developed. When hysteria causes paralysis, it is almost invariably complete, and especially so if it is flaccid. Asso-

ciated with the condition there are other stigmata of hysteria, as hemianesthesia, "glove and stocking" anesthesia, amblyopia, etc.

When a paralysis is of spinal origin with a slow development, there is associated pain and absence of the deep reflexes. Atrophy follows, the electric reactions are changed, and the distinction of this type of paralysis is so evident that a mistake is hardly possible, when any care is shown in the examination.

If cerebral lesions exist, the resulting paralysis is of the spastic type, and there are associated with it the other symptoms of intracranial disease (cephalalgia, vomiting, convulsions, etc.).

PARALYSIS IN WHICH THE MARKED FEATURE IS MUSCULAR SPASTICITY

Infantile Cerebral Paralysis.—Under this term there are included several groups of cases which have certain common clinical features. A reasonable division of cerebral paralysis would be into three groups—prenatal, natal, and postnatal.

The prenatal group of paralyses are due to defective development or possibly to intracranial hemorrhages, occurring late in gestation. At birth an infant so affected will show some loss of power, but this will usually not be the prominent feature. What is more noticeable is that there are spastic flexures or rigidity of one or more of the extremities. The type of the paralysis is generally diplegic or paraplegic. Later there are marked evidences of mental impairment, which may even amount to idiocy if the child lives.

The natal group are probably nearly always due to meningeal hemorrhages or to asphyxia neonatorum. The instances in which prolonged or difficult labor and the use of forceps in delivery are blamed as a cause may exist, but such an origin is at least doubtful and always rare. The primary symptoms, as a rule, indicate clearly the extent of the lesion. If wide-spread, there are apt to be convulsions.

Diplegia and paraplegia develop early, and are in themselves indicative of the extent of the lesion—a diffuse lesion resulting in diplegia, a less extensive one in paraplegia. Hemiplegia and monoplegia are rare. With the survival of the infant through

the first stage, the secondary symptoms will depend upon the extent and distribution of the lesion.

Usually there is more or less rigidity or spastic involvement of the extremities, but at times this is so slight that the child is brought for examination because of its general weakness and mental backwardness. In some of these cases the weakness of the limbs may be associated with a somewhat marked limberness of the neck, and this, with the general poor condition of the child, would suggest rachitis at first glance.

The spastic condition of the extremities may be well marked and also may be constant or intermittent. Spasm of the muscles of the neck may result in head retraction, and spasm of those of the trunk and neck in opisthotonos. The general condition of the infant is always poor and it remains small and delicate. In rare instances the general nutrition remains good. There is always some degree of mental impairment, which it may be very difficult to demonstrate until the child is of a considerable age. Speech and hearing are both affected to some extent, but sight is rarely involved. Many of these children do not attempt to walk until they are three or four years old, and then it is not uncommon to observe that the gait is a crossed-leg one, so that they trip themselves in the attempt; this is due to spasm of the adductors of the thigh. In severe cases the legs may be crossed while the sitting or prone position is maintained. There is an exaggeration of all of the reflexes.

Muscular atrophy of the affected limbs is marked, and the limbs are both smaller and shorter than normal. It is not of unusual occurrence for the attendant to be deceived as to the true condition, for often the history is such that one is led to believe that previous convulsions were responsible for the condition which exists; then it is that athetoid movements in some of the members or a mild localized chorea lead to a suspicion of the real cause.

Epilepsy develops in about one-half of all the cases, usually beginning as the Jacksonian type in the limb which was most affected, and then becoming general.

The Postnatal Group—Acute Acquired Cerebral Paralysis.—The etiology is usually obscure, and in most of the cases it is impossible to determine whether the infant exhibited any appre-

ciable disability at birth or not. Heredity seems to play no part in its production. A history of parental syphilis without evidences of the disease in the child is common in these cases. As to the age of occurrence, the disease has its onset in two-thirds of all of the cases before the end of the third year of life. After the fifth year the disease is very rare.

Diplegia and paraplegia are observed occasionally, but the characteristic form of paralysis is hemiplegia. The onset is sudden (the adjective acute implies that), and convulsions are present in over one-half of the cases. The convulsions are generally repeated and may be followed by a state of unconsciousness. After the first thirty-six hours the convulsions are not apt to recur.

There is an associated high temperature, and usually more or less vomiting, delirium, and other symptoms which are suggestive of some inflammatory condition in the brain, and these may persist for two or three days before the occurrence of paralysis. The temperature rise rarely precedes the convulsive seizure. In very rare instances coma takes the place of convulsions.

If the lesion is extensive, all that may be noticed with the acute onset are diplegia, coma, and death, but this is the infrequent termination. The usual course is that there is observed a typical hemiplegia, with only a slight involvement of the face or with its entire exemption.

The paralysis is at first complete, reaching its maximum of intensity between the end of the first and the first part of the second week, when there is usually a gradual improvement. The arm recovers more slowly than the leg. With left-sided lesions speech may be affected.

During the height of the paralysis sensation may be abolished, while the deep reflexes are exaggerated on the paralyzed side. Spasticity gradually asserts itself and may always be detected when a careful examination is made.

Laughing and crying bring out more clearly a stiffening of the features and a loss of expression which is present to some degree when half of the face is involved in the paralysis. There may be sluggish movement and overaction during volitional movement. Sometimes both sides of the face are involved in spastic paresis, but this is not indicative that the lesion involves more than the one

cerebral hemisphere; it is probably the result of muscle innervation, so that the muscles subserving the bilaterally associated movements of the face are not as active as usual.

The paralysis of the arm is most noticeable toward the periphery, and associated with it there is generally vasomotor paralysis, so that the limb may assume a dusky look. In the course of a few weeks the child may be able to walk by dragging the limb along. During the paralysis the leg has not suffered as severely as the arm, but the same feature is observed—that the paralysis is worse toward the periphery. While at perfect rest the position assumed by the lower limb is that of flexion with slight rotation at the hip. The foot drops somewhat, the toes in some instances being at right angles to the line of the metatarsus, or there may be equinovarus with flexed toes.

When the limb is used in walking, the gait is peculiar, owing to

Fig. 100.—Measuring the lower limb.

the limb being swung at the hip and brought across the body (generally too far), and also to the fact that, because of the shortening of the limb, the walking is done almost entirely upon the toes. This results in compensatory tilting of the pelvis and perhaps some lateral spinal curvature.

When the paralysis persists over a considerable period, there is a loss of proper development and consequent deformity. In the arm this is quite characteristic, as contracture develops there early. There usually is an adduction of the arm and the elbow is turned slightly across the trunk and pressed into it. The forearm is flexed upon the arm (nearly at right angles) and semi-

pronated; the hand is flexed at the wrist and turned toward the ulnar side, the thumb being turned into the palm and the fingers tightly closed over it.

The contractures which take place are usually so severe that even the use of considerable force while the child is completely anesthetized fails to overcome it. The distortions of joints and bone which take place under the influence of growth are varied and permanent.

It is sometimes remarkable to observe the ability shown by a child in using such a limb. While the child is prone, the limb usually assumes the hemiplegic position, and to all appearances is a useless member, but with the child active, the difference is marked. With discontinuance of activity the position of hemiplegia is resumed again.

During the first days the reflexes may be diminished or lost, but after that they are constantly exaggerated. The plantar reflex is of the extensor type, unless the paralysis is very severe, when it is of the flexor type. The sphincters are not usually involved after the first acute onset symptoms have subsided.

Hemianopia is common, but the great difficulty which is encountered in determining it accounts for the fact that it is so often overlooked. To test for it it is well to use some object that the child really desires and move it across the field of vision, noting the expression when the object is passed over into the field in which vision is wanting. When hemianopia is of brief duration, it is simply indicative of an interference with the functions of the whole hemisphere, and this may accompany an acute lesion situated at any portion of the hemisphere. When permanent, it indicates a permanent injury to the visual cortex.

Hemianesthesia may or may not be present; it is difficult to demonstrate in a young child, and is of no diagnostic import.

Aphasia is a very common occurrence and takes on different forms, but it is not permanent. The various forms are:

(*a*) Aphasia may occur as a result of the same conditions as in adult hemiplegia, but it differs in that it is affecting parts which are not fully developed and the aphasia is therefore not permanent.

(*b*) It may occur transiently when the speech centers are not at all affected. No matter what the situation of the lesion, there is

frequently an interference with the function of the hemisphere as a whole.

(*c*) Aphasia occurs in this acute disease just the same as it may in the course of any other acute illness in which there is a marked lowering of the vitality in a child who has previously spoken some.

(*d*) If the child has not already learned to speak, there is a delay in the use of speech, which may be so persistent as to alarm the parents.

Fig. 101.—Infantile cerebral paralysis. Child of seven years.

Disorders of movements are quite common as sequelæ. They are chiefly of two classes: (*a*) defects accompanying voluntary motion, and (*b*) spontaneous movements. Defects of the first class generally do not appear unless there is considerable voluntary motion possible.

While voluntary movement is possible, all the movements are executed with more or less evident effort, the action being both slow and stiff. This slow, stiff motion is most marked after the muscles have been at rest for a considerable time, and as the period of rest is prolonged, the stiffness is exaggerated in proportion. Ataxia shows itself in the clumsy, uncertain movements. Choreic movements are very evident, especially when the attempt is made to perform some definite act requiring muscular precision.

Spontaneous movements are usually of three forms: (*a*) Choreic movements appear when the spastic contracture is not marked. (*b*) Athetosis is a more common form than the preceding one, although both may appear in the same child. Unlike the choreic movements, athetosis is not marked, except in the parts which have suffered most—the periphery. (*c*) Tremor usually accompanies motion, but may persist even during periods of rest. It is of all degrees.

As regards the deformities which occur, it is needless to enumerate them; all that is essential is to remember their mode of production, and then their nature is understood. There is an arrested development affecting the bones, the joints, and the soft tissues. The result is that the measurements of all the parts is below the normal, with two exceptions. The exceptions are when there is present a fat hypertrophy of the part and when athetosis and localized chorea are present in such a degree as to produce an actual hypertrophy. The atrophies are not from disuse of the members, but are due to cerebral innervation. They vary greatly in all cases, and this seems to be irrespective of the severity of the disease.

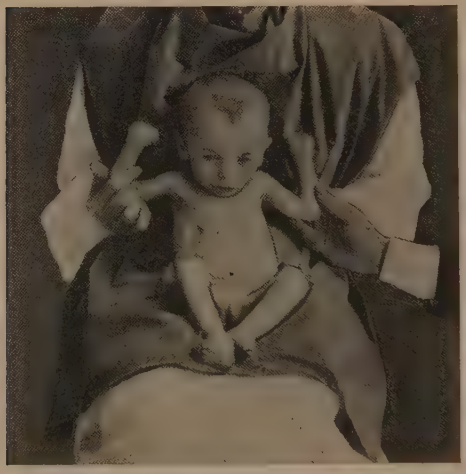

Fig. 102.—Infantile cerebral paralysis, showing hand contractures (Little).

The diagnosis between the congenital and the acquired forms may be impossible, for frequently the symptoms of the congenital types are so mild that there is no attention drawn to them until the time arrives when the child ought to sit up or walk. The differential diagnosis of the forms is not so important, therefore.

There are instances where it is very difficult to distinguish this disease from infantile spinal paralysis. A history of an acute onset, absence of sensory symptoms, the atrophied limbs and deformities may be observed in both, but, on the other hand, the spasticity, the presence of perverse or spontaneous movements, preservation of electric excitability in the paralyzed muscles, and the retention of the deep reflexes are distinguishing signs of cerebral paralysis.

The onset of the disease with its acute symptoms usually leads to a suspicion of the onset of one of the acute infectious diseases or of meningitis. The prolonged coma which is sometimes

present helps to exclude the infectious diseases, and the absence of the usual symptoms which aid in differentiating the different infections and the occurrence of hemiplegia removes all doubt.

From tuberculous meningitis the diagnosis at the onset is simple, for the prodromes of that disease are absent and the onset of cerebral paralysis is more acute. From acute meningitis or cerebral abscess without apparent cause the diagnosis at the onset is difficult, if not impossible. The early loss of consciousness, the sudden paralysis, and the short duration of the acute symptoms help to distinguish the cases of infantile cerebral paralysis.

Hereditary Spastic Paralysis.—This disease is evidenced by the occurrence of marked stiffness and rigidity of the legs, exaggerated reflexes, and contractures, but without atrophy or involvement of the sphincters. There is, as a rule, no sensory impairment. If the upper extremities are affected at all, which is very unusual, the involvement is very slight. Nystagmus is frequently present, also at times other ocular and cerebral symptoms, as amaurosis, mental impairment, idiocy, etc. There may be a difficulty in articulation.

The disease arises from the fact that the nervous system of the affected child is not capable of maintaining its normal functions for more than a few years at most. Certain parts, although apparently normal, are not endowed with the capacity for prolonged service, so that their early decay is finally brought about. The decay is most noticeable in the pyramidal system of fibers and cells, although not limited to that section. Isolated cases occur, but usually there is a definite family history which is a great aid in the recognition of the disease.

The diagnosis, of course, must be made from other conditions which exhibit a spastic paralysis resulting from lateral sclerosis. Slow-growing tumors may give rise to a similar condition, but there is an absence of any family history of like cases, and usually there is more or less pain present.

Transverse Myelitis.—When this disease is situated in the cervical region, there is a general rigidity of all the paralyzed muscles. All the reflexes are exaggerated. Incontinence of feces is the rule, associated with retention of urine until the bladder fills, and then there is an incontinence of the overflow.

The arms, the legs, and the trunk are involved in the paralysis, and associated with it there is anesthesia. The pupils may be contracted. When atrophy occurs, it generally affects the arms. The great danger to life is a paralysis of the muscles of respiration. If the site of the disease is the dorsal region, similar symptoms to the above are observed, with the exception that the arms are not involved and eye symptoms are absent. In the lumbar region there is rectal and bladder involvement from the very first, in addition to the paralysis of the lower extremities.

Fig. 103.—An incorrect but common method of examining the back. The back, in this illustration, appears perfectly normal (see Fig. 104).

In the muscles affected there may be a decided diminution in response to the electric current, and not only this, but the presence of the reaction of degeneration. There is a diminution or a loss of the reflexes. In transverse myelitis, anesthesia is produced simultaneously with paraplegia, and this is important to remember in differential diagnosis.

Paraplegia from Spinal Caries.—The clinical history of a case of spinal caries is usually one of gradually increasing weakness (in the lower limbs only if the caries is in the dorsal or lumbar regions), frequently associated with a girdle sensation, occasionally by shooting pains and an interference with the functions of the bladder and the rectum. The disease is not uncommon among children.

A typical case is not hard to distinguish. A child who is apparently healthy but perhaps not as strong as its fellows is found to tire more readily than before, and this tired condition is referred usually to the legs. If not complained of, it is noticed that the child

sits a great deal, and is inclined perhaps for any sort of quiet play except that which involves the use of the legs. There may be no pain at this stage or there may be indefinite pain in the limbs which is apt to be complained of only at night.

The disinclination for exercise and play becomes more and more marked, until the child is so weak that a stooping position is constant. With the stooping, however, there is an associated rigidity of the muscles of the back. If an examination is made of the legs at this stage, it is found that there is an exaggerated knee-jerk and ankle-clonus, and commonly the plantar response is of the extensor type.

Fig. 104.—Illustrating a better and yet incomplete method of examining the back. This is the same case as Fig. 103, and it is noted that when the clothing is removed sufficiently, a slight lumbar curve is discovered with slight tilting of the pelvis. For complete examination the child must be stripped.

Examination of the back may now show a slight angular curvature, and if so, the cause of the condition of the child is made plain at once. If the curvature is absent at this time, there may be a considerable degree of spinal rigidity, which would have the same significance as the angular curvature.

It is not always, however, that one has the opportunity to see the child at this stage, and the condition continues on, until the little one is unable to walk. The condition then is one of marked spasticity; the legs are closely drawn together and very rigid. The sphincters are involved, so that it is difficult for the child to control the action of the bladder, and impossible usually for it to control the action of the bowel.

Girdle sensation is fairly constant, but among the earliest symptoms is acute pain which radiates to the different points of nerve

distribution. No matter what the site of the caries, pain may be referred to the neck, the chest, or the epigastrium, or more rarely to the loins. When such pains occur and persist without definite and apparent cause, and associated with them there is more or less weakness of the lower limbs, it should always excite suspicion of caries.

One must not expect always to find curvature; a considerable amount of inflammation of the membrane of the cord may take place without any appreciable bone deformity, and yet it may be sufficient to give rise to almost complete paraplegia.

It is particularly true of caries in the lumbar region that there is but little deformity, but, on the other hand, rigidity is marked. It also occasionally happens that with caries in this situation the reflexes are not exaggerated, but diminished.

In the cervical region angular curvature is also not marked, but instead there is usually a noticeable thickening about the spine and marked infiltration of the soft tissue of the neck. Then, again, the arms are involved in cervical caries and local wasting of the small muscles of the hands is common.

There should be a suspicion of this disease in every case where transverse myelitis comes on without definite cause. The greatest difficulty is encountered in the early stages, and especially where there is no appreciable deformity. This may make the diagnosis impossible for a time, and the only deduction that it may be possible to make is that the child is suffering from a form of spastic paraplegia which is the result of pressure.

The only safe method is to examine the back minutely in every case of spastic paraplegia. Not only should the examination be made of the spine externally, but where there is the slightest chance of the cervical region being involved, an examination should also be made by way of the pharynx. This latter procedure would naturally suggest itself when, in a child previously healthy, there was the gradual development of weakness in all four of the extremities and with a resulting spastic condition. When there is a deformity, the symptoms associated with it are such that a diagnosis is easy. It is the duty of the physician to make a diagnosis *before* deformity occurs, whenever such is possible.

PARALYSIS UNCLASSIFIED AS REGARDS FLACCIDITY, SPASTICITY, OR ATROPHY

Amaurotic Family Idiocy.—This is a rare disease. The usual history is that the child was perfectly healthy up to three or four months of age, when there occurred a weakness of the muscles of the neck which led to an inability to hold the head erect. From this on the weakness spreads until the trunk and limbs are affected and the child is the subject of a flaccid paralysis, which is later on changed to one of spasticity and atrophy.

The knee reflexes are active in the flaccid stage; then, as spasticity replaces flaccidity, the arms and legs are the subjects of jerky movements which are quite frequent. Wasting of the muscles is extreme, with unchanged electric reactions. With the occurrence of a sharp loud noise the extremities jerk quite vigorously. Associated with the muscular weakness, and coincidentally progressive with it, there is mental impairment. The child at first is simply dull and heavy, will not notice, and cares less and less for play.

An early and constant association with the weakness of mind and body is weakness of sight, and this may in part account for the child's early lack of interest. It is not long before blindness is complete. If the eyes are examined, the characteristic condition is noted; the macula looks like a dark-red spot, surrounded on all sides by a large area which is very pale, the longest diameter being horizontal. The disc becomes paler and is eventually atrophic.

The diagnosis is made by the physical and mental conditions (which are very similar to other diplegic conditions) being associated with the visual defects and changes in the eye.

Apparent Paralysis Associated with Joint Disease.—For the purpose of diagnosis I think that it is permissible to consider these conditions here, for while they are not strictly paralyses, but simply immobilities which are dependent upon bone disease, the clinical picture is usually so much like true paralysis that they must be thought of and recognized.

With this apology for their insertion at this point we shall consider them. The paralysis which arises from spinal caries is not

included here, for it is a distinct and true paralysis, not simply an immobile condition due only to bone disease.

Acute hip-joint disease sometimes induces a difficulty in motion, and particularly if the affection is bilateral. But most often the affection is of one leg, and that is held more or less stiffly. Usually when there is a bilateral affection, one joint is affected some time after the first one, but the disease runs a more rapid course in the last joint involved. The limping which is generally the first noticeable symptom is due to abduction of the thigh, external rotation, and to the flexion which is maintained by the tonic spasm of the muscles. Anesthesia will allow of free motion.

It is not uncommon to see a child with considerable swelling of one hip or knee, or occasionally of the shoulder, and find that the child is in a state of apparent paralysis, but upon close examination the cause of the disability is found to be rheumatism.

Congenital hip dislocation results in a peculiar gait, and has more than once been diagnosed as a paralysis. As the child walks there is a lurch from one side to the other—generally more to one side, as the deformity is rarely equal. Examination shows unusual mobility of the hip, and the head of the femur is detected in an abnormal position.

The points of distinction from other conditions are: the normal bulk and conditions of the muscles, the normal reaction to the electric currents, and the normal reflexes.

Functional Paraplegia.—There is frequently encountered in the child a condition, following long or severe illness, in which the little one is unable to walk or to stand. This condition may be noted after a definite disease has persisted for some time, or it may follow an indefinite illness in which no diagnosis has been made.

The loss of power is generally not complete. The child may be able to stand but not to walk, or may be able to do the latter unsteadily, or more often in a wavering way. The musculature is somewhat flabby. Instead of unsteadiness in the gait, one or both feet may be dragged along. The reflexes are overactive, as a rule. Hemianesthesia or stocking or glove anesthesia may be present.

Its invariable occurrence is in children who are pampered, and this is the only feature which in any way gives us a clue as to its etiology. Yet when we consider the diagnosis, there is scarcely

a condition which is so difficult of recognition when one does not expect its occurrence or is not well acquainted with its occasional appearance.

If the associated symptoms have included sore throat, the danger is of mistaking it for post-diphtheritic paralysis. Other cases will markedly simulate spinal caries with paraplegia. Cerebellar tumor may be suspected in some cases in which the gait is of a rolling character.

The only possible way to diagnose it with certainty is by a rather tedious process of exclusion, for it may simulate so many conditions. Then, again, it occasionally precedes organic disease of the nervous system, and here lies another danger of overestimation or underestimation. One valuable aid in the diagnosis is separation of the little one from the mother, for in functional paraplegia this is followed by immediate improvement.

Hysteric Paralysis.—This is not common among children, although in late childhood it is not so rare. Even when paralysis does occur, it is usually of a mild type.

The condition of the musculature may be that of flaccidity, with diminished reflexes and sometimes abolished knee-jerk, or it may be of a spastic type with exaggerated reflexes and contractures. The latter is the more common of the two.

The degree of the paralysis also varies from a simple weakness to complete disability, the latter being the less common. Then, again, a few or many muscles may be involved. The type may be hemiplegic, paraplegic, monoplegic, or irregular.

In the duration, in development, and in disappearance hysteric paralysis follows no rule: it may persist for a day or for years; it may come on suddenly or gradually; it may disappear quickly or slowly. These very facts, added to the tendency to shift from one situation to another and to come and go, help to make the diagnosis clear.

Such a paralysis is unique in that its occurrence cannot be explained by any anatomic change in the nervous system. Aphonia is not uncommon and is usually quite characteristic; the voice may be completely lost very suddenly and as suddenly be regained. Or paralysis of the tongue may result in disturbances of speech.

According to the degree and situation of the paralysis, there may

be manifold symptoms, as asymmetry of the face, club-foot, wrist-drop, torticollis, spinal curvature, stenotic breathing, hiccough, squint, cough, dyspnea, dysphagia, and a host of others. Globus hystericus (sensation of a lump or ball rising in the throat) is one of the most constant occurrences in children. The dry, persistent, easily excited cough is another. Tremor is common, and when it occurs, usually persists for years and is annoying. Incontinence of either urine or feces is rare, and if these occur, they are not continued, but are intermittent or periodic.

As to the diagnosis, paralysis is sometimes the only manifestation of hysteria, so that absence of other symptoms does not of necessity exclude hysteria, so that one must in these instances be guarded in an opinion. Of course, if any of the stigmata of hysteria were associated with the paralysis, the diagnosis would be much simplified.

In distinguishing hysterical paralysis from that of an organic origin, we have the absolute lack of conformity to the anatomic laws of distribution which is noted in most cases of the former. If the paralysis is hemiplegic, then the anatomic distribution more closely approximates the organic forms of disease, but it is not generally associated with paralysis of the tongue, with aphasia or an exaggeration of the deep reflexes, and, on the other hand, there is much more sensory change than is noted in organic paralysis. Another valuable point is that if anesthesia of the legs occurs in hysteria, the sacrum and the genital organs are not involved.

A very common symptom-group is that of astasia-abasia, produced by a settled idea in the mind of the child that it cannot walk or stand. Usually there is control of the limbs while the prone position is maintained, but none whatever when the standing or sitting position is assumed. When such a condition is noted, it makes the diagnosis certain.

PARALYSIS IN WHICH THE MOST NOTABLE FEATURE IS MUSCULAR WASTING

Muscular Dystrophy.—This is a term which may need some explanation, so that we may be perfectly clear as to its use. Formerly it was customary to describe several conditions under the

term "myopathy," but these are usually described now under the term "muscular dystrophy." This latter is the better term, for as far as our knowledge of the conditions goes, it more clearly indicates the nature of the disease.

There are several types of the disease, and, while it is necessary to recognize these, it is an unsatisfactory division, for between all of them there are all degrees and grades which it is difficult to class. They all develop under the influence of heredity. The fact seems to be this: that there is inherited by the child some condition of the musculature which leads to its early destruction. Whether or not there is a relation with the nervous system is uncertain.

The different types differ mainly in these particulars:

(*a*) *Pseudohypertrophic Paralysis*.—This is the most common of the muscular dystrophies. The onset is in early life and almost invariably before the tenth year. The earliest symptoms are weakness of the lower limbs, and this is most noticeable when the attempt is made to rise from a sitting position (especially from the floor) and upon an attempt to go upstairs.

Some of the muscles may be enlarged (usually the calves, but at times it may be muscular groups in the thighs or gluteal region) while they are the seat of paralysis, and others are atrophied. While the enlargement of the calves is sometimes very noticeable, the muscles are firm and very weak, owing to a displacement of the muscular fibers.

Walking is late, and when accomplished, it is with an unsteadiness, so that the child trips and falls readily. Now, if an examination is made during the early appearance of the muscular weakness, it is noticed that apparently the muscular development is much better than would be expected with such an amount of weakness as is evidenced. While the thigh may seem to be fairly well developed, by a comparison with the musculature of the calves it will be observed that it is thinner than it ought to be.

In regard to the trunk, the musculature of the pelvis and the back is usually weak, in consequence of which there may be a more or less marked lordosis. The shoulders are thrown far back. The alteration of the muscles about the shoulder is usually marked; at first there may be slight enlargement, but wasting is soon observed. The upper arm muscles are small and weak, while those

of the forearm may be firm and apparently unaltered as to strength. However, in an examination of the musculature in any situation great care must be exercised to distinguish normal firmness from that which is the forerunner of a state of pseudo-hypertrophy. Wasting of the small muscles of the hand is rare.

(*b*) *Juvenile Type.*—This is much less frequent than the preceding type, and so far as it follows a characteristic clinical course is evidenced by progressive wasting of muscular groups, especially about the muscles of the shoulder-girdle. Like the form previously described, the disease begins in early life.

Generally, by the time that the shoulder shows much wasting, there is a noticeable weakness and atrophy of the musculature of the lower limbs. In this type hypertrophy is not a marked feature, although it may occur to some extent.

The muscles of the foot and of the leg are usually not involved. There are no fibrillary twitchings, no sensory disturbances, and no reaction of degeneration, although the response to the electric current is diminished. The organic reflexes are never affected.

(*c*) *Infantile Facial Type.*—This is characterized by the commencement of weakness in the muscles of the face, and it may occasionally be superadded to the preceding type (the juvenile), in which the shoulder is most affected. The weakness affects principally the orbicularis palpebrarum and the orbicularis oris. This results in inability completely to close the eye or to pucker the mouth. The lips are usually thickened, but all the muscles of the face are atrophied, and this gives to the face a very peculiar expression.

General Considerations of All Three Types.—The diagnosis should not be difficult when the characteristics of the different types of the disease are recalled. From progressive muscular atrophy due to degeneration of the spinal cord muscular dystrophy is distinguished by the absense of fibrillary twitchings, the rarity with which the small muscles of the hand are involved, and the age at which the condition occurs. Then there is usually the history of similar cases in the family.

In regard to the etiology, there is one point that seems clear, and that is that there is a very distinct hereditary influence. The condition is handed down from one generation to another, and sev-

eral children in one family may suffer. The male members suffer more frequently than the females, yet the females frequently transmit the disease.

The course of the disease is progressively worse until complete disability ensues. The progress is in most instances very slow, lasting for years, so that the changes from month to month even are scarcely perceptible.

Peroneal Form of Muscular Atrophy.—This disease is characterized by an early affection of the peroneal muscles, but from there it may be spread so as to involve the anterior tibial group or even the muscles of the calves. Generally the development of the disease is symmetrical, but occasionally one leg is apparently affected more than its fellow.

Wasting of the musculature is the marked feature, and naturally this is accompanied with more or less loss of power. Wasting takes place by a gradual disappearance of the muscular fibers; there is never any hypertrophy of the muscles. Fibrillary twitching is frequent, but not constant, and there occurs a gradual extinction of faradic contractility. When the disease spreads from the peroneal group, it may involve the thighs, the upper arms, and rarely the pelvic and shoulder girdles. The face is not affected.

Frequently the only symptom that a child will present at first is a decided wasting of the muscles below the knee, and when tested with the faradic current, there is no response. The ball of the thumb usually suffers next (some writers classing this as "the hand type of muscular atrophy"), and the wasting is in no particular different from that which has affected the muscles of the leg. If it spreads from here, then the muscles of the forearms are involved. Now, the condition presented is this: the legs are wasted below the knees, the arms below the elbows. Deformities are the rule; that will be readily understood.

The course which the disease takes is variable, for frequently there are observed periods during which there seems to be a perfect standstill of all symptoms, and this may last for months. In other cases when one of these quiescent periods occurs, it seems to become permanent. The tendency, however, is to progressive change from worse to worse. This is without question a heredi-

tary disease, but what further etiologic factors exist we do not know.

The diagnosis is made easy by the characteristic development of the paralysis and its distribution. There is practically no danger of mistaking it for infantile spinal paralysis, as the onset is so very slow and the other features so entirely different.

Muscular dystrophies exhibit features which are somewhat similar and may result in some difficulty in differential diagnosis, but the situation of the wasted parts, the frequent occurrence of fibrillary twitching, and the affection of the small muscles of the hand (when it occurs) offer points which should at once lead to an exclusion of dystrophies.

Syringomyelia.—This is a very rare disease, and the name is applied to that condition in which cavities exist in the spinal cord, other than congenital malformations. As regards the symptoms, there are three distinct kinds: those which have to do with the muscular apparatus, sensory symptoms, and trophic disturbances.

In regard to the first, there is progressive muscular atrophy, the atrophy in most instances affecting the small muscles of the hand. Associated with this there may be a wasting of the shoulder musculature and more or less marked lateral curvature of the spine. Unilateral paralysis of the face and wasting of the tongue may also occur, but this is certainly an unusual happening. Less frequently still, the muscles of the lower limbs are affected.

The sensory symptoms show nothing which is constant. It is not infrequently the case that the limb which exhibits the most marked wasting suffers the least from sensory disturbances. The sensory symptoms which are characteristic when present are not so much of impairment as of dissociation of sensation.

Heat and cold are not distinguished at all, yet the slightest touch is noticed. While the light touch will be detected, the child may often be jabbed with a needle and not complain, simply making the statement that some one touched him. This peculiar disturbance of sensation leads to injury, usually burns. This condition rarely affects the lower limbs, but may be observed in portions of the face, back, and chest. In a few instances there will be noticed no sensory disturbances at all.

Trophic and vasomotor disturbances are usually very marked.

Extreme redness of a limb is very common, and there is usually associated with this excessive perspiration of the limb. In other cases the excessive redness and sweating will become general. Sometimes the joints seem to be affected with a condition which disorganizes them. The bones are fragile. Other trophic and vasomotor changes may be present, as abscesses, cyanosis, coldness, bullous eruptions, etc.

Fig. 105.—Scoliosis from syringomyelia. Female seven years old (Napier).

The diagnosis is made certain if there is that peculiar muscular atrophy associated with the characteristic sensory symptoms described and the vasomotor disturbances. But one or more of these may be absent; then a difficulty arises in distinguishing this disease from progressive muscular atrophy in which the small muscles of the hand are affected. To make the distinction clear, the history must be most carefully taken and the examination of the child must be most thorough; otherwise errors are readily made.

Cervical pachymeningitis may at times closely simulate this disease, and a child with wasting of both hands and upper limb with sensory symptoms might be the subject of either disease. But if the sensory symptoms were characteristically dissociated, then it would favor a diagnosis of syringomyelia. If this was absent, then one would consider the presence of lateral curvature, and in the absence of both the diagnosis would most probably be cervical pachymeningitis. The history is an aid, pachymeningitis having a more acute onset.

Peripheral neuritis would hardly be mistaken, for the pain in the nerves, the diminution in the reflexes, and the history, especially of etiologic factors, would be of immense service.

ATAXIA

Incoördination of movement, in which the act is imperfectly carried out, owing to the inability properly and accurately to adjust the various muscular movements to each other, and which is known as ataxia, occurs in an acute and chronic form. Ataxia is especially liable to affect the lower limbs, and the result is a difficulty in either walking or standing, or there may exist an inability to do either.

Under conditions which are perfectly normal there is a more or less pronounced swaying of the body when the child stands perfectly erect with the feet close together. This swaying is forward and backward, as well as lateral, and if the eyes are tightly closed, the motion is increased at least 50 per cent. With even a slight impairment of the power of equilibrium the motion is increased in all directions.

In a consideration of the ataxic gait a very clear distinction must be made between ataxic gait (in which there is imperfect coördination of movement) and spastic gait (in which there is rigidity of the limbs), as well as the gait which is due to weakness (in which one or both limbs behave as though they were partly paralyzed).

In ataxia the lateral sway of the trunk which takes place in walking is much increased (particularly when the eyes are closed) and it takes on an irregular character. As regards the foot, there is an increase in the outward sway and also in the height to which the foot is raised from the ground. The foot-fall is not regular.

In the spastic gait the limbs are held rigidly and there is but little action at the knee. The foot is not well abducted, as is normal, but instead may be slightly adducted, and it is scarcely raised from the surface. The result is that frequently the advancing foot interferes with the movements of the other by being carried in front of it. The sway of the body is much increased and is most noticeably toward the side which is opposite to the advancing foot. It is the sway that assists in the raising of the foot from the ground.

This sway is associated with attempts at motion, and is not irregular, like the ataxic gait. One of the chief characteristics of this gait is that it is much slower than the normal.

In weakness the limbs act somewhat like pendulums, being swung into position instead of deliberately carried there. The weight of the body is not thrown upon the leg, which rests upon the ground until the knee has been slightly retroflexed.

When we consider the etiology, we are able to place all acute ataxias in one of four groups:

(*a*) The cerebral or spinal type: This is dependent upon some involvement of the central nervous system.

(*b*) The neurotic: In this group there seems to be a distinct neurosis, and the child does not exhibit any organic changes in the nervous system. In this group are included hysterical ataxia (in the form of astasia and abasia) and the reflex ataxias (especially those dependent upon some sexual condition).

(*c*) The infectious: Diphtheria leads in this group, but variola, scarlet fever, syphilis (in the second stage), and occasionally typhoid are all at times causative factors.

(*d*) The toxic: This is the rarest group in childhood, because the little one is too young to be exposed to the influence of the substances which are usually causative of this group (alcohol, arsenic, mercury, and lead).

Hereditary Ataxia.—This disease almost invariably attacks the child between the ages of six and ten, and after the disease has once started, the course is usually progressive. It is not unusual, however, to observe periods of apparent quiescence which may persist for several months or a few years.

The first symptom which is noted is difficulty in locomotion; the gait of the child, instead of being steady and uniform, is characterized by an occasional lurching, the feet being brought down with increased force and not being placed in a proper position to maintain a perfect balance. Even while the child is standing the feet are not well placed, but are widely spread apart in the effort to maintain a more stable equilibrium. Almost invariably the eyes are fixed upon the ground while the standing position is assumed.

The difficulty in standing and in walking becomes progressively

worse, until there may be an inability to do either. As the disease advances other phenomena are added. The speech becomes affected; the words are cut short, and this gives a peculiar explosive nature to their utterance.

Movements of the hands and arms become involved (usually four or five years after the onset of the disease) late in the disease, and of still later occurrence is the affection of the head and trunk. Even in the presence of a very wide-spread involvement the sphincters are but little affected, if at all.

Muscular contractures finally take place, and these add deformities to the other symptoms. Humped foot is a common occurrence (an excessive arching of the dorsum, hollowing of the inner and inferior aspect, and inversion), and a lateral curvature of the back may become at times extreme. Pupillary reaction remains normal, but nystagmus is a very common occurrence. The deep reflexes are almost invariably lost, but in some instances instead of this there is a marked diminution. General weakness is more or less evident, and anemia is usually marked.

With the exception of some emotional disturbances or moderate instability, the mental condition of the child does not suffer. I know that this is not in accord with the popular view, but the errors of diagnosis have been so many in the past before the condition was well understood that the view has gained credence that the mental condition suffers severely.

The one prominent feature of the disease is its affection of more than one member of the family. It is usually this history which first leads to a correct diagnosis of the disease. It might be confused with hereditary cerebellar ataxia, but that is a disease of later life, being exceedingly rare before the twentieth year, so that we need not consider it at this time. Hereditary tabes dorsalis (juvenile) sometimes closely resembles in its symptoms hereditary ataxia. It is characteristic of the disease that it begins in early life (about the seventh year).

Sometimes the very first symptom is that of lightning pains which are referred to the legs. This is almost always associated with weakness of the limbs, ataxia, and abolished knee-jerk. In other instances the first symptoms are those which affect the vision, and are the result of optic atrophy. These eye symp-

toms may increase to such an extent that blindness may supervene, while the ataxia remains as a minor condition as regards its severity. The pupils remain inactive to light.

One feature of the disease is the lost knee-jerk; this may be very noticeable (entirely lost or markedly diminished) even when the ataxia is so slight as to be scarcely observed. There are two features which are very pronounced in the etiology of the disease —heredity and the influence of syphilis. The lightning pains and the eye symptoms of this disease are absent in hereditary ataxia.

PAIN

It is almost impossible to formulate a perfect definition of pain, and I do not know that it is necessary to spend much time trying to, for we have all experienced it, although not always able to define it.

In infancy pain is very difficult of recognition, for many of the features which usually accompany it are present in conditions in which there is no pain appreciable. Some of these features are a tense pulse, hurried respirations, drawn features, restlessness, etc.

Being a purely subjective symptom, its intensity and even its presence must be estimated by the manifestations of its presence, as one is able to observe them, by the nature and extent of the condition which is the probable cause, and, lastly and least important, by the statements of the child or its parent.

Even in children of considerable age and intelligence there is encountered much difficulty in determining both the existence and the intensity of pain. Recognition of the existence of pain is usually left to the statements of older children, but this should always be substantiated by other evidences, and most of these evidences are used in the detection of pain in infancy.

In childhood, when the child is too taciturn, when the child exaggerates or is incapable, for any reason, of accurately describing the sensation of pain, we rely more upon the evidences of it as seen in the drawn features, livid countenance, dilated pupils, shrieking or crying, the various assumed postures, the indisposition to move certain members, and so forth.

By far the largest factor in the proper estimation of the existence of pain, and its character and intensity, is the ability of the observer to properly gage individual susceptibility, and this can never be learned from books. There can be no question as to the existence of very marked differences in pain perception in different children; and, further than this, so many things, especially nutritional conditions, influence or modify pain susceptibility in the same individual at various times. Another element is whether the pain is

acute or chronic, for children do not bear pain well at any time, and if long continued, it finds the little one less resistant.

Tenderness must not be confounded with pain, although the relationship is very close. It is the production of painful sensations by pressure, and pain is usually associated with tenderness. This is not invariably the case, so that it has some value in diagnosis, particularly in the recognition of transferred pains. Pressure over the part complained of by the child may elicit no pain, but when we are able to locate the cause of such complaint, then pressure over the point of real trouble shows tenderness.

Mode of Onset.—If the onset of the pain is sudden, it is indicative of the acuteness of the causative factor; if of gradual development, it proves to us that there is no solution of continuity, and that the causative factor is of slow development. Short duration of the pain indicates the same as acute onset; long continuance meaning the same as gradual onset.

The time of occurrence is of some value. Headaches recurring in the late afternoon are almost always due to anemia or weakened heart. Pain at night is very suggestive of periosteal inflammation. Pain immediately following a meal is suggestive of some digestive fault, and if delayed for a considerable time and referred to the abdomen, then of some intestinal one. Then, again, we may have pain referred to some other functional act, as its increase or occurrence with respiratory acts, urination, defecation, etc.

Character of the Pain.—This may be an indication of the nature of the cause:

(*a*) Acute, stabbing pain is usually observed in the acute inflammations, and if radiating, it is suggestive of neuralgia or neuritis.

(*b*) Dull pain occurs mostly as the result of inflammations of the mucous membranes, the parenchymatous viscera, or when inflammation has been of long standing. It is also seen in visceral affections.

(*c*) Constant and boring pain is encountered in affections of the bones and in periosteal diseases.

(*d*) Aching pain or soreness indicates that the affection is of the musculature.

(*e*) Burning or itching pain is most commonly observed in skin diseases.

(*f*) Remitting pain is suggestive and characteristic of colic, neuralgias, and cramps of all types.

(*g*) Pain increased by motion is observed in all inflammatory processes, diseases of the bones and joints, and in rachitis and scurvy particularly.

Site of Pain.—The site of the pain usually corresponds quite closely with the situation of the causative factor. This is not always so, and perhaps a better way to state it would be to say that the site of pain depends upon the nerve distribution from the local process which causes pain.

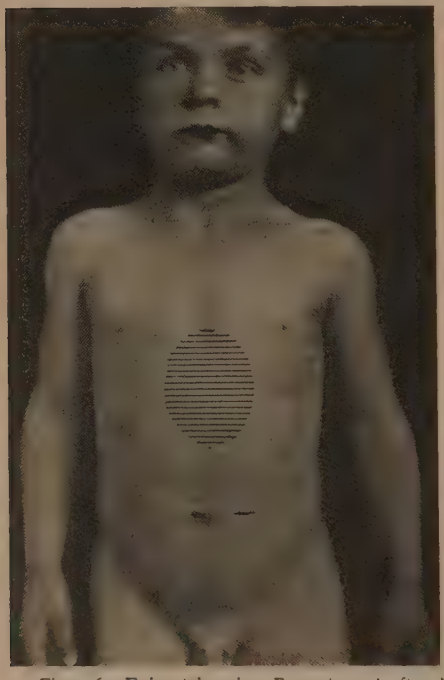

Fig. 106.—Epigastric pain. Present most often in gastric neuroses, gastric catarrhs, gastric erosions, duodenal ulcerations, vertebral diseases, pneumonia (commonly), gastralgia.

Generally diffused pain occurs fairly constantly in children with all the febrile processes, and particularly with those of an infectious nature, so that its diagnostic import is very small.

Pain in the lateral wall of the chest has as its most common causes pleurisy, intercostal neuralgia, enlarged bronchial glands, vertebral disease, pneumonia, and disease and injury of the chest walls.

Pain in the precordial region is usually due to gastralgia, pericarditis (rare in children), angina pectoris, and pseudo-angina.

Pain about the diaphragm may persist for a time after severe vomiting or after prolonged coughing and is commonly present in pleurisy.

Epigastric pain generally depends for its cause upon some one

of the gastric neuroses, gastric inflammation, vertebral disease, or pneumonia.

Pain in the upper extremity is most commonly due to neuritis, enlarged axillary glands, and bone disease. If confined to the left arm, it may be due to enlarged spleen.

Bilateral pain is usually of central origin or due to disease of the vertebra.

Spinal pain is complained of most often in spinal curvature, vertebral disease (relieved by extension), diseases of the meninges (is associated with muscular spasm), and is observed in many cases of rachitis and scurvy (in which it markedly simulates organic disease).

Pain in the lower extremity is usually due to rheumatism, hip disease, psoas abscess, perinephritis, or sciatica.

Pain referred to the joints may be due to synovitis, osteomyelitis, tubercular bone disease, rheumatism, scurvy, or more rarely to rachitis.

Substernal pain is quite characteristic of bronchitis.

Pain in the ear is almost always due to acute otitis or mastoiditis.

No attempt has been made to cover all the conditions which give rise to pain in various situations, for this would involve the use of much space and would be of slight value. All that has been attempted has been to refer to some of the most important and common causes.

Pain in the abdomen and headache are two quite important symptoms during childhood and are considered in separate parts (see "Abdominal Pain," page 123; "Headache," page 312).

There are, however, some diseases of childhood whose chief and earliest symptom is pain, and it is almost invariably that which leads us to the discovery of the real trouble; these will be considered at this time.

DISEASES IN WHICH PAIN IS THE EARLY AND PROMINENT SYMPTOM

Acute Otitis.—This is a very frequent disease in children, and one which occasions much suffering. It is usually secondary to scarlet fever, influenza, acute pharyngitis, rubeola, or diphtheria. The

symptoms are very variable, but there are two which are characteristically constant—pain and fever.

In the beginning there is generally some nasal discharge, moderate fever, and slight congestion of the pharynx, but there is nothing about this condition to lead one to suspect the onset of otitis. After two or three days these symptoms subside and the infant begins to be very fretful and restless, worrying most of the time and occasionally crying out sharply. While the little one is evidently ill, the cause remains obscure. If the child refuses to allow the ear to be touched or refuses to lie upon that side which is affected, it is a good indication that otitis is developing. After several days a discharge from the ear is noticed, and this at times is the first symptom which leads to an appreciation of the real trouble. In older children the symptoms are less obscure and pain is usually the feature most complained of. It is sharp and severe and comes on very early in the attack.

The usual range of the temperature in an attack of otitis is from 100° to 103° F., and the course is irregular and remittent. Usually after rupture has taken place the temperature falls to about normal. In older children pain is apparently a more marked feature than it is in infants, because they are able to communicate the reason of their distress, the ear-drum is tougher and ruptures less easily, and the inflammation is usually catarrhal. When it is possible to examine the ear, there is redness and congestion of the tympanic membrane early in the attack. Later there is either bulging of the same or evidences of its rupture.

The diagnosis is much easier in older children than in infants, and particularly on account of the pain which at once directs attention to the ear. In infancy, however, it may be very difficult to make a diagnosis before a discharge from the ear appears. The temperature is indicative of trouble somewhere, but there is nothing about it or the associated symptoms of restlessness, anorexia, or the host of other ones which will reasonably suggest a cause. If the definite local signs are absent, then the diagnosis is presumably made if there be faucial congestion without any further signs of throat or lung involvement, the history of a sufficient etiologic factor, and the exclusion of other causes of the fever.

Gastralgia.—This is evidenced by the appearance of sudden

and severe gastric pain, and may occur as an accompaniment of severe attacks of acute gastric indigestion. Such a pain must be at once distinguished from the pain caused by pleurisy, and this may require an extended examination. It could hardly be mistaken for the pain which occurs in this situation and is the result of spinal caries in the dorsal region, for the latter is less severe and of a chronic nature.

As it is very apt to recur from time to time in children who are predisposed to it, the history of previous attacks may be of much value.

When the attack is mild, the pain intermits and there may be no other symptoms. When more severe, pallor, cold sweating, and considerable prostration may accompany the pain.

MENINGITIS

The inflammations which affect the membranes covering the brain and the spinal cord may be located in the dura mater (pachymeningitis) or in the pia arachnoid (leptomeningitis), and frequently the two are existent together.

PACHYMENINGITIS

The acute form is very rare in children and usually commences as a localized process, extending later to the inner layer. The chronic form almost invariably affects the inner layer, and is not so rare, although its discovery is usually at autopsy.

Pachymeningitis is usually dependent upon morbid processes in the contiguous bone, so that it is commonly the result of infectious conditions of the nasal cavity, the middle ear, or the orbit.

The symptomatology depends more upon hemorrhage than upon the inflammatory process, for until hemorrhage occurs the disease is rarely distinguished. The onset of hemorrhage is evidenced usually by vomiting or by convulsions, or, in case the hemorrhage is gradual, there may be simply the occurrence of increasing stupor. There may be a large variety of cerebral symptoms which are indefinite, and, generally speaking, pachymeningitis has no definite symptomatology apart from the conditions with which it is associated.

LEPTOMENINGITIS

The involvement of the meninges in leptomeningitis is general, and not localized, like pachymeningitis. According to the position, we have several forms, as vertical, basic, posterior basic, ventricular, spinal, cerebrospinal, and general. If the form is not very acute, there is a tendency to localization, but with the acute forms diffused processes result. In accordance with the pathology there are several varieties recognized—the tuberculous, suppurative, epidemic, and syphilitic.

TUBERCULOUS MENINGITIS

This disease is almost invariably secondary to a tuberculous process in some other portion of the body. There are no constant features relating to its onset, but when emaciation and general weakness have been of long standing in a tuberculous child, the onset is very apt to be somewhat rapid. On the other hand, it is in those instances in which the child withstands the ravages of the disease well that the occurrence of this secondary infection comes on rather insidiously and is not expected. As a general thing there are more or less ill-defined prodromes which are present for a few days or several weeks.

Traumatism occurring in a tuberculous child seems to have some determining element about it, and while we are not able to explain just why or how an injury to the head will result in tuberculous meningitis, we cannot ignore an influence which is so pronounced in so many cases.

The prodromes are as varied as they are indefinite; there may be simply a period of evident but slight illness, and again there may be marked apathy, fretfulness, grinding of the teeth at night, disturbed sleep, and disinclination to play. The first and the last mentioned are the most suggestive ones.

Vomiting may occur without an adequate cause and without preceding nausea, and while such a symptom is indefinite, it is very suggestive if associated with constipation and fetid breath. So many times when vomiting occurs it is treated as due to some digestive disorder, and so often the onset of tuberculous meningitis is at first evidenced by vomiting that one should always look upon a precipitate or apparently causeless vomiting with much suspicion when it occurs during the course of tuberculosis.

The whole aspect of the child is soon one of evident but indefinite illness, with an associated tendency to mental perversion or sluggishness, which is unusual to the child. There is a disinclination to talk or play, and this may be so marked that errors are made in the speech or the words are drawled out with evident effort. In other instances there is absolute refusal to speak, to walk, or even to stand. Generally the child assumes a frowning expression and may show strong dislike for those whom it has

previously loved. I regard the change of disposition as of great importance.

As the prodromal symptoms become more pronounced, the child may lapse into a condition in which it seems to care for nothing, and then cephalalgia is usually a prominent feature. Delirium may also occur at this time or an attack of convulsions. As the tubercle develops in the meninges before there is much inflammation or exudation, we readily see the reason for the prodromal symptoms. That is, during the prodromal stage the tubercle is developing, but it is not until the occurrence of the inflammation that the disease finally declares itself.

Fig. 107.—McEwen's sign. Tympanitic note upon percussion over the lateral ventricle of the brain. Present in many cases of meningitis, especially the tubercular type.

It is rather difficult to separate the stage of active symptoms from the preceding stage, as they are merged into one another, but at times the separation is made unfortunately plain by an attack of general convulsions. With the termination of the prodromals the expression of the face changes from a frown to a vacant expression, which is only intensified by the partly opened mouth, the staring eyes (the child stares as at some distant object), and the pupils being dilated. It is common to observe some retraction of the corners of the mouth.

The general surface of the body is unusually dry except just before death occurs. The position assumed is usually one-sided, with a most marked rebellion against the slightest interference. As the disease progresses the limbs may become rigid and extended and the head retracted, but this latter is usually somewhat transient, coming and going. There is invariably a retraction of the abdomen.

Hydrocephalic cry, which has been looked upon as of so much value as a means of diagnosis, is of doubtful value, for it occurs frequently in other intracranial affections of childhood.

Toward the end of the first week of the active symptoms ocular phenomena make their appearance, and we may observe all grades and varieties of strabismus and ptosis, rolling movements and independent movements of the eyeball. Oscillation of the pupils is not infrequent.

Repeated rhythmic movements are common, as champing, grinding of the teeth, sucking movements, etc. There may be also coarse tremors, and particularly when motion of a limb is attempted. While an absolute paralysis is rare, partial paralyses are common.

Fig. 108.—Hydrocephalus (side view).

The convulsions which occur are either general or may be localized, and the usual order is first localized convulsions, then general convulsions as the terminal. After the appearance of convulsions there may be rigidity, for this is the time for such to occur, and each convulsion causes an increase in the rigidity. Loss of sphincter control is the rule.

There is marked irregularity of the pulse very early in the prodromal stage, and this irregularity persists. At first there may be an increase in the rate, but later it becomes slow with more tension. As the disease reaches a terminal period the pulse becomes soft and rapid. The respiration is at first rapid, and as a rule with some sighing, but later it usually becomes of the Cheyne-Stokes type. The temperature is that of tuberculosis, but when fever previously existed, the attack evidences a lowering of the temperature, and so it may remain low throughout the course of the disease.

Tâche cérébrale (by drawing the finger-nail along the skin of the abdomen there appears, after a few seconds, a distinct red streak, which is from one to two inches wide and remains for from three to five minutes) is nearly always present, but is not pathognomonic.

The diagnosis is made early only when one is on the lookout for the disease and refuses to accept an apparently causeless vomiting as an evidence of digestive disturbance. Naturally enough, the cerebral symptoms which are associated with some one of the acute gastro-intestinal disorders may be misleading, but in a child, whenever there is a considerable weight of evidence to explain the cerebral symptoms, the decision that the trouble is tuberculous ought to be made with some reservation.

Fig. 109.—Front view of hydrocephalic infant.

It is usual for all of the symptoms of the prodromal stage to be accounted for upon the basis that all are due to the constipation which is present, but the history of the previous condition, the occurrence of causeless vomiting without preceding nausea, and the influence of a brisk cathartic (failure to relieve) should leave one with little doubt.

When pneumonia is present and meningitis develops during the attack, there is a close similarity to tuberculous meningitis, but such a combination is unusual, and in doubtful cases the chances are in favor of the diagnosis of tuberculous meningitis. The bacterial examination of the cerebrospinal fluid is of doubtful value, being somewhat uncertain.

POSTERIOR BASIC MENINGITIS

While basilar meningitis is almost always tuberculous, there is a chronic form of the disease which is not tuberculous, and this is

the disease which is considered at this time. The uniformity of the symptomatology makes the diagnosis rather easy.

The disease occurs almost always during the first year of life, and about nine-tenths of all cases occur before the end of the first twenty months of life, after the third year the disease being exceedingly rare. The onset is somewhat rapid, with the first symptoms rather mild, and yet distinctive; these symptoms are: (*a*) retraction of the head; (*b*) tonic convulsion; (*c*) vomiting.

Any one of these symptoms will be the first thing to attract attention, but no matter which one appears first, the other two quickly follow it. Vomiting is the least constant feature of the three, but when it occurs, it usually persists throughout the whole course of the disease.

The most characteristic and also the most constant symptom is that of head retraction. This may persist for some time in such prominence that it overshadows all other symptoms, but it is generally associated with tonic spasm. The extensor muscles of the neck are first involved, but soon the deeper ones are affected. The deep muscles are hard and also tender, and any attempt to overcome the spasmodic contracture causes severe pain. In the cases that result fatally this contracture persists throughout the course of the disease, but gradually subsides if the case goes on to recovery, giving way to a very considerable weakness of the musculature.

The tonic spasm consists of head retraction and opisthotonos, the latter being extreme, as a rule. Opisthotonos may exhibit periods of partial remission, but there is never a complete subsidence. When the limbs are affected, the spasm may be either persistent or intermittent, and as intermittent spasm is generally of the flexor type, affecting all the limbs, the position assumed is a very much cramped one. Persistent spasm is of the extensor type and all the limbs are affected equally. The face may show evidences of spasm, so that the expression becomes mask-like.

Within twenty-four hours of the onset the child becomes languid and very irritable, and this persists while the disease lasts. Bulging of the fontanelle is common and present early, and is generally associated with prominence of the superficial veins of the head. This is caused by a moderate degree of hydrocephalus.

Outside of the foregoing symptoms, which are prominent and characteristic enough to mark the disease, there may be nystagmus, strabismus of a transient and changing character, champing, grinding of the teeth, etc., which are common to many of the cerebral diseases of childhood. There is usually a shallow coma (irritability alternating with drowsiness) and cerebral group breathing (four or five normal respirations followed by long pause, then a deep sighing inspiration), which are common to many conditions of cerebral depression.

The pulse is generally rapid or normal, rarely slow, and pupillary reaction is generally normal. Paralysis is not actually

Fig. 110.—Kernig's sign. The thigh is held at right angles to the body. When an attempt is made to extend the leg, bringing it into a line with the thigh, there is either marked resistance or an inability to extend the leg, if meningitis is present.

present, but the contractures render the child practically helpless. Febrile symptoms are usually entirely absent, but may be present in a moderate degree.

The course of the disease is fairly typical, and the duration is from four weeks to five months; in rare instances it may be protracted to one year.

At first the disease must be distinguished from all other diseases which begin with moderate elevation of temperature, retraction of the head, and perhaps with vomiting. If, in a child below the age of three years, there is retraction of the head which has occurred rather suddenly and associated with little or no fever, one might

suspect tuberculous meningitis, otitis media, or posterior basic meningitis. The fact that there is little or no fever would be against a diagnosis of otitis, and an examination of the ear would be of immense aid. Usually in otitis, when retraction occurs, it is intermittent, while in posterior basic meningitis it is constant. In any event, after four or five days the question as to the presence of meningitis is definitely settled, but not so as to the type.

Tuberculous meningitis occurs almost invariably as a secondary infection to tuberculosis in other parts; it affects children over two years of age, in nearly every instance, head retraction is not marked, hydrocephalus is of a different degree, the abdomen is retracted, slow pulse is the rule, and the duration is shorter. In contradistinction to this posterior basic meningitis occurs usually in the first year of life, there is no abdominal retraction, head retraction is marked, bradycardia is rare, and the duration of the disease longer. The prominence of the opisthotonos in posterior basic meningitis is distinctive also.

ACUTE SUPPURATIVE MENINGITIS

The causative factors of this disease are many, so that they are not always helpful in diagnosis. Among the more important, however, are insolation and injury to the head, the extension of infective disease of adjacent structures, and particularly suppuration in the nasal cavity and middle ear, and infective diseases in general, as scarlet fever, smallpox, rubeola, enteric fever, influenza, pneumonia, etc.

The onset of the symptoms is usually very abrupt, and there are no prodromes. It is not reasonable to look upon the manifestations of the antecedent disease as prodromes, for they have no connection with the meningitis except as the disease acts as an etiologic factor of it.

Generally there is a severe convulsion or a severe rigor, which is almost immediately followed by high elevation of the temperature. Headache is soon intense, and usually associated with photophobia and irritability, and these are soon followed by delirium, which is sometimes very violent and soon lapses into a coma, about the third day. Vomiting and constipation are the

rule. If the disease occurs in a child with open fontanelle, then this becomes markedly prominent.

During the occurrence of coma, which generally lasts from the third day until death, which is usually before the eighth day, other symptoms make their appearance, and these are the signs which are generally present in other forms of meningitis, as retraction of the head, general extensor rigidity, champing and sucking movements, grinding of the teeth, irregular movements of the eyes, strabismus, etc. Pulse and respiration are both rapid throughout the course of the disease, and toward the end become irregular.

While there can be no clear clinical distinction made between stages of this disease, yet one must be struck by the fact that there is a more or less well-defined stage of irritative phenomena and one of paralytic symptoms.

The whole clinical picture is so plain that the diagnosis offers no difficulty except in those cases in which the meningitis occurs during the course of some severe adynamic condition, and under those circumstances the severe symptoms of the onset are very apt to be absent, and the gradual development of the paralytic symptoms are our only guide. As these are somewhat modified by the symptoms of the antecedent disease, the difficulty is at times great. But by recalling that this form of meningitis may occur during the course of any of the severe general infections, one is forewarned in regard to cerebral symptoms which are not accounted for in some other way.

EPIDEMIC CEREBROSPINAL MENINGITIS

The occurrence of this disease has almost invariably been during periods of mild weather which closely follow cold which has not been excessive. The outbreaks of the disease are usually simultaneously in remote regions and without any regard to the routes of travel, the food-supply, or the water. The symptoms are far from being constant, each epidemic showing marked variations and each individual epidemic following no regular type.

Preceding the onset of the disease there may at times be a period of one or two days in which indefinite symptoms of headache,

general malaise, and rigors are more or less prominent. Following this prodromal period, which may be entirely absent, there is the sudden occurrence of vomiting or convulsions (sometimes of both), intense headache, and high elevation of temperature (103° to 105° F. or more). The pain soon spreads from the head, going down into the back and to the limbs, and this is usually accompanied by a general hyperesthesia. Associated with these symptoms there is generally a marked restlessness, which is later followed by delirium and finally coma.

Rigidity of the neck musculature is marked; the head is retracted and opisthotonos is usually present. The respiration is slow and irregular and the pulse weak (it may be either slow or rapid). The eyes are almost invariably suffused early in the disease, but later on destructive panophthalmitis is common. Cutaneous eruptions are not infrequent and may be in the form of erythema, herpes, or more commonly petechial spots.

These symptoms may cover a course of from two to ten days or, in rarer instances, the disease may be protracted for several weeks, and while the disease is running its course, recovery or death may occur somewhat unexpectedly at any period of the disease.

If recovery takes place early, it may be complete; but if it is delayed for days, then there is almost always some permanent disability of the eyes, of hearing (from a destructive otitis media), of motion, or of sensibility, so that many times the child is left in a crippled condition or both blind and deaf. Convalescence, in any event, is very tedious.

The two fatal forms of the disease are the hemorrhagic (evidenced by the occurrence of cutaneous and other hemorrhages) and the adynamic (with sudden onset, rapid collapse, and cardiovascular depression which may prove fatal within twelve hours). The adynamic cases are difficult of diagnosis except in the presence of an epidemic. The fact that an epidemic is raging is of great importance in the early recognition of the disease, and most important of all is the discovery of the specific germ in the cerebrospinal fluid.

The greatest difficulty in early recognition will be encountered in the presence of an epidemic of one of the acute infectious exanthemata being prevalent at the same time, but such errors

may be avoided by a careful consideration of the prodromes, which are fairly typical in these diseases, and the appearance of the characteristic eruption.

Pneumonia may readily be excluded by the physical signs or by a bacterial examination of the cerebrospinal fluid. There is no preceding history of tuberculosis, the attack is more acute, more severe, and more painful, than in tuberculous meningitis, and that helps to distinguish these two.

THE TEMPERATURE

Previous to taking up a consideration of an elevation of the temperature it will be well briefly to speak of chills.

CHILLS

These may vary in intensity, so that in the mildest form they are evidenced as "creeping" feelings running up and down the spine, or they may exist as true rigors, in which the child shakes violently for a half hour or even more. In infants and very young children a chill is not common, its place being usually taken by a convulsion, which in that particular has the same significance as the chill of the older child.

Clinically, a chill indicates the onset of some severe infection, and the severity of such infection cannot be judged by the severity of the chill; a slight chill may announce the onset of a severe infection, and vice versâ. Again, a chill (of some degree) is an essential symptom of some diseases, as malaria. Occurring during the course of certain diseases, a chill indicates some complication or further extension of the process; as in typhoid, it suggests a secondary or a mixed infection.

If chill is associated with profuse perspiration and this is frequently repeated, it is indicative of pyemia, septicemia, or some purulent inflammation. Chills from depressing drug action and from nervousness are uncommon during childhood.

FEVER

The body-temperature of the child is maintained uniformly at about 98.6° F., and this is due to the control exercised by the central regulating apparatus. When for any reason this thermotaxic mechanism is interfered with, there is a disturbance in the stability of the temperature, and fever, which is an elevation of the temperature, is the result.

The estimation of the temperature in the child should never be attempted by the sense of touch, for this is a most deceptive and unsatisfactory method. The proper use of a clinical thermometer is an absolute necessity. The temperature is best taken by the rectum in children, as it is a more exact method. That is, it is more exact if it is properly performed; it is uncertain if the thermometer is plunged into the rectum for one or two inches, as is usually done, and then left there for a time. By such means one is never certain that he has not buried the end of the thermometer

Fig. 111.—Method of taking the rectal temperature of an infant or young child.

in a mass of feces, which would give an incorrect result. The instrument should be slowly introduced at least for two inches, and then, while it is retained in the rectum, it must be very slowly withdrawn for an inch and again pushed in, and this procedure kept up for a sufficient time to obtain a correct registration (which latter depends upon the thermometer).

If for any reason the rectal method is unavailable or undesirable, the temperature may be taken in the axilla, but to insure accuracy certain precautions must be observed. The axilla must be dried

thoroughly, and the thermometer must be accurately placed in the arm-pit and not with the bulb beyond the posterior fold of skin (as is often done). After the instrument is placed, the arm should be carried across the chest in an easy manner and retained there by some one other than the patient; this is necessary, because if the arm is held rigidly, it creates a hollow in the arm-pit, and when the thermometer rests in this, the result is not accurate.

Taking the temperature by the mouth in children is as uncertain as it is unnecessary.

In estimating the temperature it must be remembered that the rectal method of taking it gives a result which is normally four-fifths of a degree higher than that which would be obtained by the mouth, and which is usually taken as the standard, and an axillary temperature is close to one degree lower than that of the mouth.

The daily variations of the temperature which are physiologic are not of sufficient importance in diagnosis to warrant their discussion in this place.

Symptoms of Fever.—We will first consider the general symptoms and then take up some more in detail.

In children fever is evidenced, at first, usually by a disinclination to prolonged play or activity, by unusual thirst, fretfulness, accelerated pulse, coated tongue, highly colored urine, and perhaps a flushed appearance of the face. With these symptoms present an examination shows that the temperature is elevated.

The elevation of the temperature is not the only evidence of fever, however. Wasting of the solid tissues is a very marked symptom, and is observed even in a moderate fever, provided it extends over a protracted period. While the solid tissues waste, the fluids of the body also are diminished in amount, and this is the chief reason why we observe glandular disturbances in the course of fever. The reduction of the fluids also accounts for the occurrence of increased thirst, the loss of appetite, and the digestive disturbances which are usually present. Diminution in the amount of urine and its concentration and constipation are all due to the same cause.

Increased pulse-rate is the rule in pyrexia, and is in all probability directly due to the increase in the temperature, but this

may be influenced by other conditions. For instance, in meningitis the pulse may be characteristically slow in relation to the height of the fever, while in diphtheria and other diseases in which fever is the rule there may be a markedly accelerated pulse-rate, but absence of fever.

Increased respiration is the rule and is much more constant than increased pulse-rate.

Diagnostic Significance of Fever.—The presence of fever is diagnostic in that it generally excludes hysteria, and in many other diseases (as, for example, convulsions, which is a common syndrome of childhood) it largely influences the conclusions. These are all discussed under the appropriate headings. When fever is present in the child, it implies that there is a disturbance between the normal relations of heat production and dissipation. This may be occasioned by an infarction, an intoxication, a cerebral lesion, or some peripheral irritation.

There are several reasons why the occurrence of an elevation of the temperature is not of as much diagnostic significance in the child as in the adult:

(*a*) The heat-producing centers are more easily excited, on account of the immaturity.

(*b*) The heat-controlling centers show a similar immaturity, and as a consequence there is a weaker control. These two foregoing conditions in the child account for the occurrence of high temperatures from apparently very trivial causes.

(*c*) The heat-dissipating apparatus or mechanism is very much more active than it is in the adult, and this accounts for the variability of the temperature during most diseases.

Causes of Fever.—These may be predisposing and exciting. Of the former, we encounter a neurotic inheritance and chronic states of malnutrition, both of which interfere with the perfect mechanism of the heat centers at the base of the brain.

Of the exciting causes, the most important are the infections, whether local or general, the vast majority of which are now recognized not so much by the inflammation which is produced, but as being dependent upon the presence of microörganisms in the inflamed part, from which toxic materials enter the general

circulation, producing fever by a direct action upon the thermogenic centers.

All infectious diseases without local inflammatory lesions are also recognized as exciting causes of fever. The autointoxications are not so important in childhood as in adult life, being less common.

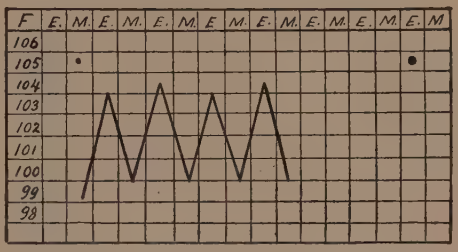

Fig. 112.—Represents a hectic and suppurative fever type, which is generally accompanied with sweating.

If a cerebral lesion (tumor, thrombosis, etc.) involves the centers controlling heat production and heat dissipation, disturbances of the temperature will result. Direct exposure to external heat, as in insolation, will produce fever, and as insolation in infants is always accompanied by more or less intestinal disturbance with fermentation, a toxic element is added which tends to keep up the pyrexia.

In very young or very delicate infants the application of external heat will at times produce an elevation of the temperature which is seemingly out of all proportion to the cause.

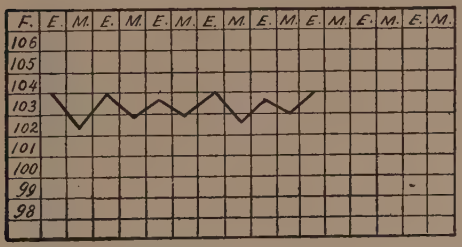

Fig. 113.—Represents a continued fever. It is observed mostly in erysipelas, acute tuberculosis, lobar pneumonia, and typhoid fever.

Peripheral irritation will readily produce pyrexia in a poorly nourished infant, and examples of this are commonly observed in the fever which is associated with the difficult cutting of the teeth, the presence of undigested food in the intestinal tract, or foreign bodies, such as intestinal parasites.

Significance of the Type.—For the reasons already stated, the height of the fever in children is not of considerable importance, and when compared with similar intensity in the adult,

its relative unimportance is very marked. The type of the fever is of far greater importance in diagnosis than the intensity.

Continued Fever.—This is evidenced when the pyrexia continues for forty-eight hours or more and when the daily difference between the maximum and the minimum temperatures is not more than two degrees Fahrenheit. It is observed in erysipelas, acute tuberculosis, lobar pneumonia, and typhoid fever. In lobar pneumonia it is particularly characteristic, suddenly reaching a high degree and continuing with little variation for several days, until the crisis occurs, when the temperature becomes normal or subnormal. In acute tuberculosis, more than in any other condition, there is long-continued fever.

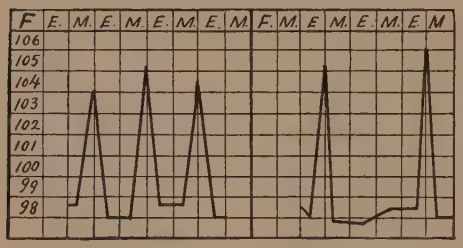

Fig. 114.—Represents intermittent fever. The left hand half showing the quotidian type, while the right hand half shows the tertian type. It is significant of malaria.

No case of typhoid fever ever occurs in the child without fever; during the first four or five days the temperature shows a progressive rise, with morning remissions and early evening exacerbations until the acme is reached (which is usually about 104° F.). Then the temperature remains nearly stationary (slight morning remissions and evening exacerbations) until the middle of the second or the beginning of the third week, when lysis occurs.

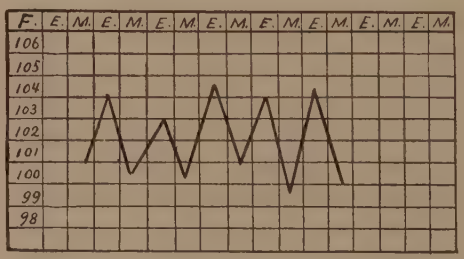

Fig. 115.—Represents the remittent type. This is suggestive of one form of malaria, of tuberculosis (not acute), and suppuration.

Intermittent Type.—This is evidenced by the rise of temperature being followed by a fall which is to or slightly below normal, and the same occurring periodically. The typical intermittent type is observed in malaria. It is simulated by certain cases of

typhoid, tuberculosis, and in suppuration, when the pus is confined. The distinction from malaria can be readily established by an examination of the blood; if the plasmodium malariæ is found, it is positive evidence of malarial infection.

Remittent Type.—This is characterized by a persistency of more than forty-eight hours, but with a difference between maximum and minimum temperatures of more than two degrees Fahrenheit. Such a type is characteristic of one form of malaria, but may occur at any time during the course of any disease which is accompanied by fever, and particularly if it be of an intermittent type. This type of fever in children is peculiarly significant of tuberculosis (except the acute form) and of suppuration. It may be simulated by a continued fever which is subject to marked remissions shortly following the use of antipyretic measures, and this possibility must be thought of.

Subnormal Temperature.—This occurs independently of pyrexia and is the usual sequel of protracted pyrexia and conditions accompanied with marked wasting of the tissues. During the course of a fever it may indicate that a crisis has been reached, or may be due to an accident or to complications. Occurring at the expected time, it indicates a crisis; occurring at any other period during the disease, it is suggestive of complication or accident.

ENTERIC FEVER

Of the essential symptoms of typhoid fever, the most important, as regards diagnosis, is the temperature which is invariably present. No case of typhoid fever is ever present in the child without an elevation of the temperature, and, further than that, the course and the duration of the fever are such that in most instances the diagnosis is much simplified, even when the other symptoms are not strongly indicative.

Preceding the onset of the febrile period of the disease there are usually several days during which the little one exhibits indefinite symptoms of general malaise, anorexia, and restlessness, all of which lead one to the conclusion that the child is not well, but which do not allow of a definite diagnosis. Occasionally, however, one will encounter cases in which the most carefully taken history will fail to reveal anything unusual preceding the rather sudden onset. These latter instances are not the common ones, but occur frequently enough to leave one with nothing about the onset of the disease which is at all suggestive; it may be gradual, or may occur more suddenly, with vomiting, rapid pulse, and sometimes with a convulsion.

Profuse perspiration, herpes of the face, and a temperature which shows a complete remission, taken singly as symptoms at the onset of a disease, are strongly against a diagnosis of typhoid. On the other hand, epistaxis and a temperature which shows a steady rise and is uninfluenced by the administration of antipyretics (particularly quinin) is very suggestive of typhoid fever.

It may be well to mention the fact at this point that the use of the internal antipyretics at the onset of typhoid fever (and frequently during its course also) in children very commonly results in a slight elevation of the temperature, which is noticeable a few minutes after the administration of the same.

With nothing suggestive about the onset the danger is in mistaking the symptoms as evidences of other diseases. The most frequent error is in diagnosing the case as one of acute

indigestion, for at this period the only means that we have of differentiating the two is the history (of some definite etiologic factor in indigestion, and of infection in typhoid) and the fact that in typhoid fever the quickened pulse, which is out of all proportion to what we would naturally expect in the presence of such a temperature, is a very early occurrence, as is also splenic enlargement.

Now, in regard to the latter, while it is usually a very early accompaniment of typhoid fever, it is by no means constantly so, nor is the enlargement ever as prominent a feature as in adult life. It is generally possible to map out the enlarged spleen by palpation after the second or third day of the disease, but later it becomes much more difficult, for by the end of the first week the tympanites may interfere with the examination. To be of real diagnostic value the splenic enlargement must be of recent occurrence; that is, we must be satisfied that it was not present for some time previously. Too much stress has usually been placed upon the value of this symptom, but I have found that, in my cases, in about 50 per cent. it is not demonstrable after moderate tympanites occurs, and in a large proportion of the cases one is not positive of its recent occurrence.

Naturally without a very clear history and a very typical course one would not diagnose typhoid fever in a child under three years of age, and considerable doubt would exist, under like circumstances, in a child who was under six years.

During the first four or five days of typhoid fever the temperature shows a progressive rise, with remissions in the morning and exacerbations in the late afternoon or evening, until the acme is reached. The morning remissions are generally within two degrees Fahrenheit.

After this period, the temperature having reached its acme, it remains at this height with slight morning remissions and evening exacerbations which are not marked, so that the difference between the highest and lowest daily temperatures is well within one and one-half degrees Fahrenheit. Such slight remissions occurring during the second week of the disease are quite typical, and are probably due to the fact that ulceration is not as frequent nor as extensive in the child as in the adult. From the middle of the

second or the beginning of the third week termination by lysis begins to evidence itself.

In very young children the fever runs a course of from eight days to fourteen days, and before the age of ten years a longer course is infrequent. After the tenth year of life the disease in all its particulars more closely approximates the adult type.

During the first six or seven days of the disease the general symptoms are so variable in young children and so misleading that it is almost impossible to make a diagnosis of typhoid fever except by exclusion. The character of the temperature is of most importance in the recognition of the disease, so that we first exclude all local causes for the elevation, and this still leaves us

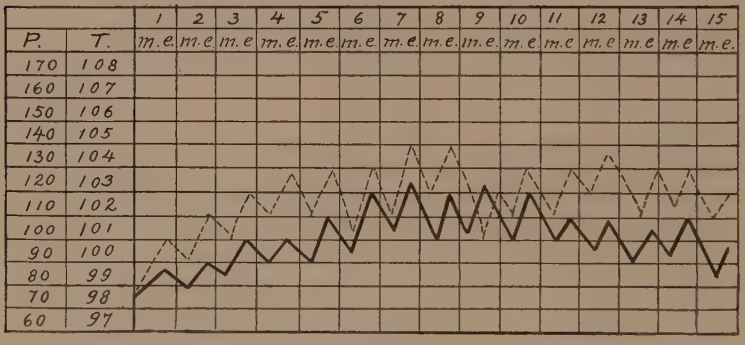

Fig. 116.—Chart of the temperature (——) and pulse (----) in typhoid fever of moderate severity in a male child five years old.

in doubt as to which of the infectious processes is present. After the third day it is usually possible to exclude, without any doubt, the acute infectious exanthemata, for the characteristic eruptions are absent. In the same manner cases of influenza (especially that type which has slight catarrhal symptoms), by the short duration of the active symptoms, are readily excluded.

Symptoms which are referable to the nervous system are very apt to be more prominent in children than intestinal symptoms, and this leads to many an error in diagnosis. The more common nervous symptoms which are present in adults (subsultus tendinum, coma vigil, dry glazed tongue, carphologia) are absent in children. Of all the nervous symptoms which are present, cephalalgia and mild delirium are the most constant in childhood,

and are particularly marked during the night. The very young child is usually dull or in a state of semi-stupor. There may be hyperesthesia, opisthotonos, unequal or contracted pupils, strabismus, etc. Such symptoms may suggest meningitis.

Between tuberculous meningitis and typhoid fever the differentiation may at times be difficult, but such difficulty will only be short-lived, as the differences are soon well marked. Probably much of the difficulty is occasioned by the fact that tuberculous meningitis is thought of more often than is typhoid fever. The chief difference exhibited by tuberculous meningitis is that it usually runs its course with little fever and almost invariably begins with an attack of vomiting, which is repeated upon several

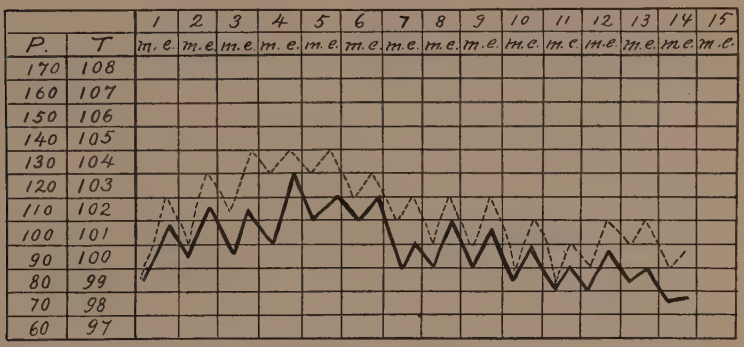

Fig. 117.—Chart of the temperature (——) and pulse (- - - -) in typhoid fever in an infant of seventeen months. This case was one of four in the same family, the splenic enlargement and eruption being marked in all.

successive days. Then, again, cephalalgia is more or less severe and constant in meningitis, so that if the vomiting and the headache are prominent and continued symptoms, typhoid fever may reasonably be excluded.

After a few days (four to six) meningitis becomes much more pronounced in its symptoms, leaving much less room for doubt as to the cause; the pulse becomes abnormally slow and irregular, the child becomes somnolent, and the abdomen is either sunken or flat.

A true difficulty is encountered in those rare cases in which tuberculous meningitis runs its course for several days with little or no appreciable cerebral symptoms. Such cases are no doubt

due to an acute miliary tuberculosis with subsequent involvement of the meninges.

It is in these cases that splenic tumor and the presence of rose spots of typhoid fever are such welcome aids to the diagnostician.

In the absence of these, then, the symptoms must be considered carefully one by one, and the etiology and previous history are of great import.

While ulcerative endocarditis very closely simulates typhoid fever, as a matter of diagnosis it does not cause much concern because of its rarity in childhood. There is an associated splenic enlargement and also a discrete eruption which is quite similar to that observed in typhoid fever. The temperature, however, is markedly of that type which accompanies ulcerative processes generally (marked remissions, chills, and profuse perspiration).

The demonstration of splenic enlargement is not of great value in the diagnosis of typhoid, although in the differentiation from other diseases it has a distinct value at times. Of much greater import is the eruption of typhoid rose spots, but even this symptom is only present in about 60 per cent. of the cases and is very much less characteristic than in adults. The spots are a palish pink, slightly elevated, and disappear under pressure. They are about the size of the head of a pin and are not abundant in number. Their appearance takes place between the sixth and eleventh day, as a rule, upon the abdomen, chest, and back, and more rarely upon the limbs. Each spot persists for about three days, but as they appear in successive crops, the entire period during which they are in evidence is several days.

The condition of the bowels is never a criterion of the severity of the infection (as is so often supposed), and in most cases diarrhea is not present, and when it is, it is of a mild type, from two to four stools being the daily average in the child. There is nothing about the stool itself which is at all characteristic. Tympanites is rarely extreme, and is usually only present in a moderate degree.

When the attempt is made to differentiate typhoid fever from an acute miliary tuberculosis, much difficulty may be experienced at times, but this is considered under another section (see page 434).

Value of the Widal Test in Typhoid Fever.—This test depends for its existence upon the property of the blood-serum of a patient suffering from typhoid fever to cause an agglutination of the bacilli, when added to a fresh bouillon culture of the bacilli, so that they sink as a rather flocculent precipitate. It is not always present, even in undoubted cases of enteric fever, so that its value is much decreased. There are on record several instances in which repeated attempts resulted in a negative result of the test and the subsequent autopsy gave evidence of undoubted typhoid fever.

Then, in persons who have once had the disease, for an indefinite period, which differs with the individual, there exists in the blood-serum the property of giving the reaction, even without the presence of any evidence of ill health. The value is further lessened by the fact that it is not possible to obtain the desired result early in the course of the disease, but only well along into the second week, and rarely before the seventh day. Usually before this time the diagnosis has been made.

Value of the Diazo Reaction.—This reaction of the urine, which may be demonstrated to some extent in cases of typhoid fever, is of even less value in the diagnosis than the Widal test, for it is much more apt to be absent. Another feature which destroys its utility markedly is its undoubted presence under other conditions. There is no disease in which the reaction is so marked as in rubeola, just about the time of the appearance of the cutaneous eruption.

MALARIA

There is but one thing that is at all certain in malaria as it is exhibited in infants and young children, and that is its periodicity. There may be any one or a combination of several indefinite symptoms, which may point toward some other condition being the cause, and none of them particularly indicative of a malarial infection; but if out of this diversity of symptomatology there is anything which shows a periodicity, then malaria should at once be suspected as the cause.

Because of this variableness, it is almost impossible to give a fair description of the disease, and all that can reasonably be done is to give the symptomatology of a somewhat typical case, with emphasis upon the fact that it is typical and should not mislead one into the error of expecting just such conditions to arise in any given case. Diversity of symptoms and periodicity are the two strong diagnostic features of malaria, and these are corroborated by an examination of the blood for the plasmodium.

The incubation period of the disease has become quite well established as being fourteen days. During this period there are no symptoms which are at all suggestive, and when present at all, they are indefinite ones of anorexia, lassitude, and some slight gastric disturbance. When the attack itself is developed, then the symptoms are usually divided into well-defined stages if the child is over the age of seven years. Under that age, uncertainty rules.

In children over seven the first stage is "the cold stage," which generally begins with a sensation of great lassitude and some headache, and perhaps a decided chill and vomiting. At this time the appearance of the child is somewhat peculiar, in that the temporal grooves appear to be sunken, the nose looks pinched, and the eyes are deep set, with darkened borders. The skin is usually very pale and the feet and hands cold and the nails blue.

This stage is almost immediately followed by the "hot stage," which is evidenced by the onset of high temperature (104° to

106° F.), which persists for from four to twelve hours, with a gradual fall, which is generally to normal. The constitutional symptoms are not in proportion to the height of the fever, being much milder than one would look for with such an elevation of temperature. During this stage the skin, which has been pale, becomes markedly flushed, but remains dry, and this is associated with dryness of the mucous membranes of the mouth, resulting in an intense thirst.

Then follows the "sweating stage," in which the skin, which was previously dry and hot, becomes gradually moist, until finally a rather profuse acid perspiration covers the whole of the body. This moisture is first noticed upon the forehead and in

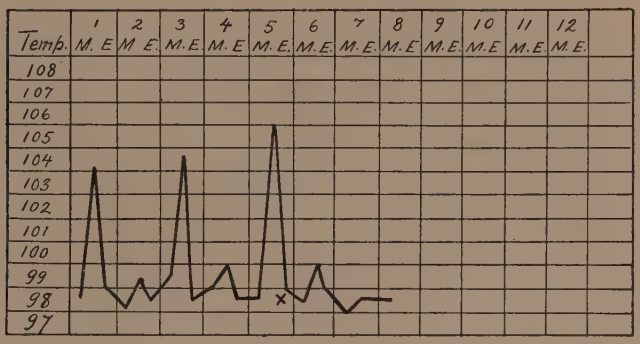

Fig. 118.—Tertian type of malarial fever. Male child of six years. Quinin begun at X.

the axilla. If the subjective symptoms have not entirely abated or decreased in severity during the early part of the hot stage, they do so at this period, so that there is a complete subsidence of all such symptoms. Sometimes the manifestations of the sweating stage are so slight that there is danger of its being overlooked. It usually lasts somewhat longer than either of the preceding stages.

With the complete subsidence of the paroxysm there is usually a quiet, restful sleep, from which the child awakens refreshed but visibly weakened. Then there may follow a period of several hours or longer, when a second paroxysm occurs. It is according to the length of this interval between the paroxysms that we recognize the following types of the disease: Quotidian, recurring

every day; tertian, with an interval of one day in which there is an entire absence of symptoms; quartan, with an interval of two days, the paroxysm occurring on every fourth day.

As has already been stated, the irregular forms of the disease are the most frequent among children, and particularly those who are under seven years of age. As would be expected, considering the irritability of the child's nervous system and its immaturity, the commonest type is that which has its chief symptoms exhibited through that system. In such masked forms headache is usually a marked feature, and is associated with more or less drowsiness and gastric disturbance, so that under certain

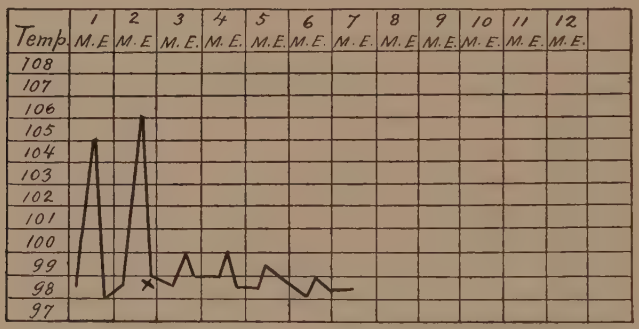

Fig. 119.—Quotidian type of malarial fever. Female child of eight years. Quinin begun at X.

circumstances it may lead one to suspect the presence of tuberculous meningitis.

In other instances, and this is particularly true of infants, the congestion which accompanies the paroxysm may be so acute and severe in the lungs that, giving rise to obscure symptoms, an error in diagnosis is readily made. Pain referred to various portions of the body is not uncommon, and epigastric pain may mark the onset of a paroxysm.

And so I might go on, and recite instance after instance of the frequency of irregular forms and of obscure symptoms. It is sufficient, however, to state that two things are needful, and are also sufficient, for the diagnosis of malaria in children under seven years (and many over that age): periodicity and the subsidence of all symptoms under proper anti-malarial treatment. Demonstration of the plasmodium in the blood of the patient is a valuable

aid, but not a necessary one, a negative result not excluding the disease.

Disregarding the general symptoms, which may take many forms, I shall proceed at once to a consideration of the means which we have at hand for making a correct diagnosis. These will be considered in the order of their relative importance.

(*a*) Demonstration of the plasmodium malariæ in the blood. When this is present, the diagnosis of malaria is positively made. The plasmodia may be few in number, so that, whenever possible, the blood which is to be examined should be drawn just previous to or during the febrile stage of the paroxysm (if such exists), and the extra precaution should have been observed that no anti-malarial treatment was given for at least seven hours preceding the time of the withdrawal of the blood for examination. The examination must be undertaken by one who is experienced in the technic of such work, because the possibility of obtaining a negative result from faulty manipulation is very large. Even in the hands of the experienced it is difficult at times to demonstrate the presence of the plasmodium, so that a negative result is by no means conclusive, for the means of overcoming all the difficulties which influence the examination are not always at hand. Many times the blood examination is not practicable, and reliance must be placed upon other things, which are considered below.

(*b*) Periodicity of the manifestations: In the very young the occurrence of a well-marked intermittent fever is the great exception, most of the cases assuming an irregular intermittent type. The masked and irregular forms simulate so many different diseases and are so misleading that no matter what the manifestations may be in a given case, if there is a distinct periodicity about them, one is warranted in being strongly suspicious of malaria. That such a periodicity depends upon malarial infection should be proved or corroborated by the administration of the anti-malarial treatment and the effect noted.

(*c*) The prompt effect of the administration of an anti-malarial treatment. Quinin has but little, if any, effect upon fevers which are not malarial, and, on the other hand, if it is properly administered, the fevers which are immediately and permanently controlled by its use are of malarial origin. Such a therapeutic test then becomes very valuable in all doubtful cases with obscure

symptoms. It is not sufficient simply to administer it there must be a reasonable certainty that it is absorbed.

(*d*) Splenic enlargement: Too much emphasis has been usually laid upon the value of enlargement of the spleen in the diagnosis of malaria in children. Such an enlargement occurs in many of the disorders of infancy and of childhood. At times it is very difficult to demonstrate, being present but in a slight degree. As an aid to the diagnosis of malaria its value is practically *nil*, unless associated with it there are manifestations of periodicity.

(*e*) Exposure to infection: In a primary attack, if the history showed that the child had been exposed in a malarious district, such information might be of some small value. On the other hand, if there have been previous attacks, and with similar symptoms, then such information is of great value, on account of the marked tendency of the disease to recur.

In subacute forms of the disease the most marked feature is the anemia. Splenic enlargement is also usually marked. The rise of temperature may be very slight and so variable that the thermometer must be used several times daily to discover its presence. These, with the general symptoms, may be accounted for by the anemic condition, so that one is only justified in making a positive diagnosis of malaria by the demonstration of the plasmodium in the blood, or by the effect upon the symptoms of the therapeutic test.

The chronic forms may at times simulate tuberculosis when the latter occurs with indefinite symptoms and no discoverable local lesions. Here is where a clear history is very important, both as regards the family and the occurrence of previous disease. The absence of splenic enlargement and the absolute failure of an antimalaria treatment immediately to improve the condition would at once eliminate malaria as the cause.

Pyemia may exist, with the pus collecting in a cavity or in a parenchymatous organ, so that for a time all local signs are absent, and the fever and indefiniteness of all the symptoms may lead to a suspicion of malaria. Suppurative bone disease may for a time exhibit a similar picture, and particularly in infants who cannot complain of definitely located pain. A thorough physical examination in both of the above instances should remove most of the doubt, and this may be supplemented by the therapeutic test.

TUBERCULOSIS

This infectious, communicable disease, which was at one time, and not long since, considered rather a rare occurrence in infancy and early childhood, now occupies a large place and an important one in pediatric study and in infant mortality.

A predisposition to the occurrence of the disease may be local or general. A local predisposition is caused by any pathologic condition of the parts which are exposed to infection, as repeated attacks of bronchitis, the presence of adenoids and hypertrophied tonsils, etc. Certain diseases also are more liable than others to be followed by some tuberculous process, as is observed in rubeola, pertussis, and influenza.

No organ of the body is exempt, and several organs may be the seat of the disease at the same time. The bacillus gains entrance to the body by various routes, even at times passing through the placenta of the mother to the child *in utero*. However, most of the infection is air-borne. It is not important that these points be dwelt upon, as they are not within the scope of this work, and besides they are ably and elaborately discussed in nearly all works upon the disease. What concerns us more for the purposes of diagnosis is the varieties which are seen at the various ages of life.

During the first two years of life the disease occurs almost uniformly as an affection of the bronchial lymph-nodes and of the lungs, and in such cases the cause of death is usually pulmonary tuberculosis; more rarely the cause is tuberculous meningitis. The latter is rare, however, except as it occurs as a secondary condition to the pulmonary infection.

After the period of infancy has been passed, tuberculous meningitis which is unassociated with pulmonary involvement is more common, and so much so that between the beginning of the third year and the end of the fourth year it is a frequent cause of the deaths from the disease.

From the end of the second year tuberculosis of the bones, of

the mesenteric lymph-nodes, of the peritoneum, and of the intestines is not uncommon as a primary affection of these parts, although other portions of the body do not escape the ravages of the affection.

There is a very marked diversity in the early symptoms of tuberculosis, and this diversity is influenced largely by the peculiar constitution of each individual, the source and also the extent of the infection. Like many other things in medicine, by inoculation experiments we are able to prove that there is an incubation period in this disease, but when it comes to a question of the practical application of that fact, we are helpless; clinically, we are unable to define or establish it. The general symptoms are in most cases unrecognized until the local ones appear.

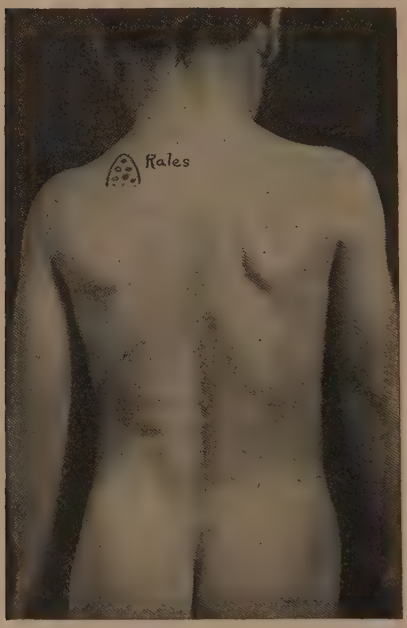

Fig. 120.—Showing the situation of fine crackling râles which are heard upon or after coughing and at the end of inspiration in the early stages of pulmonary tuberculosis.

The best method of the early diagnosis is the recognition of the tuberculous diathesis and the application of auscultation of the inspiration. In auscultation of the inspiration there should be no differences between the right and left side. I firmly believe that if we were more skilled in the art of auscultation and our ears trained to appreciate slight differences, more early diagnoses would be made of this white plague.

There are, however, peculiarities which distinguish the disease from the other infectious fevers: it has a marked tendency to become chronic; it produces characteristic lesions in the various organs and parts of the body that are invaded.

The disease is generally characterized by a progressive loss of flesh and strength, which is not so noticeable at first, but which in

the later stages is very marked. Night-sweats are common, beginning toward the time of night when the temperature falls. Then there are usually marked evidences of anemia, of more or less intestinal disorder, and of fever. The temperature, however, is atypical, as a general thing is not marked, and frequently is so slight that it entirely escapes notice.

The purest type of the disease is observed in that form which is an acute general infection and which is observed so frequently in infants. There is usually a marked and rapid loss of flesh and strength and innumerable and varied objective symptoms are associated, as one organ or another becomes more prominent in the infectious process.

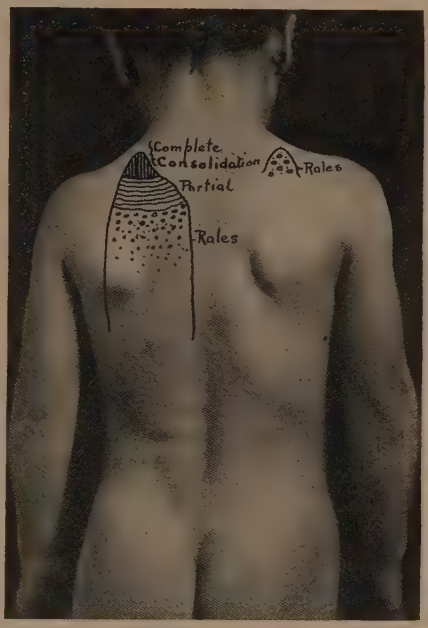

Fig. 121.—Showing the condition which is most common in the later stage of pulmonary tuberculosis.

Generally, in spite of the most rigid regulation in the diet and its most careful preparation, the infant fails to thrive, and loss of appetite, vomiting, and diarrhea or constipation may lead to a suspicion of some digestive disorder. The child steadily loses despite every care. Cough is usually not a marked feature at this time. The general symptoms are due in the main to a general intoxication, to local irritation, and to interference with function.

The whole course of the disease exhibits a steady and rapid failure of nutrition and of function, and as each day passes the child is less capable of performing those physiologic functions which are necessary to health and eventually to life. In many instances such cases are diagnosed as marasmus, and this is not surprising when the similarity is so great.

Every precaution should be shown to obtain a clear history of the little one's family, of its past and present surroundings, and of the possibility of infection. The history will usually (almost invariably) show that the marasmic baby was perfectly nourished at the time of birth, and later on in its career there occurred a definite cause for the present condition, and this cause was either improper feeding and care or occurred as a consequence of some gastro-intestinal disease.

Upon the other hand, the tuberculous child is usually very poorly nourished at the time of birth, or it shows such a condition very shortly after birth without adequate cause being found for the same. In other instances the infant has some disease which renders it more liable to infection (as in the catarrhs which are associated with rubeola, pertussis, etc.), and following that disease signs of inanition and wasting occur without sufficient cause. A careful examination fails to reveal any error of diet or feeding, and such a history should at once arouse a suspicion of tuberculosis.

But the diagnosis cannot be positively made until later in the disease, when the local signs are discoverable, usually in the lungs. If the elevation of the temperature has been marked enough up to this time to give evidence of its hectic character, it becomes now more irregular, but is never high unless in the presence of some complication. The cough becomes a feature now, but is not wearing. Accelerated breathing occurs, and is out of all proportion to the low temperature. The local signs in the chest may be those of a bronchopneumonia or of a localized bronchitis. The gastro-intestinal tract at this stage becomes the seat of many and marked disturbances, which are in nearly every instance traced to the generally devitalized condition of the child.

The typhoidal type of the disease occurs in older children, and because of their greater vitality they resist the ravages longer than the infant. The tedious malaise, increasing loss of strength, intestinal disturbances, and the supervention of a typhoidal state may make the similarity to enteric fever somewhat marked.

The fever is of a more continued type, and preceding its development there is usually an indefinite period of indefinite symptoms, which, looked upon separately, are of apparently little consequence, but which, taken collectively, are very suggestive. Such a child

is usually delicate, and without apparent reason there are marked anemia, little or no gain in weight and strength, and an easily deranged digestive system, so that the symptoms are simply those of a general decline without adequate cause.

After a few weeks of such symptoms fever appears, and while it is not high, it is continuous and without apparent cause. Then, in from one to three weeks, local signs develop. Associated with the fever there is one constant sign—wasting, which may not be rapid, but is invariably progressive.

Cough is present and may prove wearing to the child, and the physical signs are those of a bronchopneumonia associated with the general symptoms of the typhoid state. Breathing is accelerated, and the physical signs are generally situated at the apex of the lung.

It is before the occurrence of definite local signs that the diagnosis is so difficult, and the history is of great value in differentiation, the long prodromal period being markedly in favor of a diagnosis of tuberculosis. Then we must consider carefully the etiologic factors of each disease.

It may happen that the latter are not clearly determined and the obtaining of the family history may be unsatisfactory, and in that situation some dependence might have to be placed upon the occurrence of a recent tumor of the spleen. If the typhoid infection is severe enough to simulate tuberculosis, the splenic enlargement is marked, while in tuberculosis, if such an enlargement occurs at all, it is slight.

It will be necessary to inquire carefully into the fact as to whether or not typhoid fever is epidemic. If the Widal reaction is active, it is strong proof of typhoid fever. In favor of a diagnosis of tuberculosis are the atypical but not very high fever, severe cough, continuance of the symptoms unabated during the third week, and constipation. There may be cough in the first week of typhoid fever, due to an associated bronchitis, which is common, but the cough is never severe; the disease shows some amelioration during the third week, and diarrhea is rather common.

When the tuberculous process becomes localized in the lungs, there is then a combination of symptoms which are dependent upon the general characteristics of the affection in addition to those

dependent upon the particular type of lung involvement. A child who is suffering from a tuberculous infection of any part of the body, or who is affected with any exhausting condition, may readily develop a tubercular bronchopneumonia.

Tuberculous pneumonia exhibits signs practically similar to those of simple bronchopneumonia when a physical examination of the chest is made, except in one particular, and that is of position of the signs. Either disease may affect any portion of the lung, but there is a distinct preference shown, in the large majority of cases, tuberculosis affecting the anterior portion of the lung, the mammary region, the axillary region, or the apex. If the location is posterior, then the apex is the part affected usually. On the other hand, simple bronchopneumonia affects, by preference, the lower lobes posteriorly.

After the seventh year of life the physical signs of tuberculous pneumonia more closely approximate the adult type. The physical signs naturally group themselves under four heads: localized bronchitis, partial consolidation, complete consolidation, and the formation of a cavity.

Then there is a further natural division, based upon the clinical course of the disease: the rapid cases, in which the duration of the disease is from four to eight weeks, and the protracted, in which the affection lasts from two to eight months. But whether the case is rapid or protracted, there is little difference in the general symptoms.

The data upon which a diagnosis is based are of two kinds: that which relates to the patient and that which relates to the disease.

The family history must be carefully gone over and especially in regard to the occurrence of either recent or remote cases of tuberculosis. Then inquiry should be made in regard to the freedom of attendants from the disease, and also of the playmates. All the surroundings of the child must be examined by the physician, so as to determine the possibility of a source of infection.

There are many other facts that will help one to a correct diagnosis: if acute symptoms develop during rubeola and persist, there may be a tuberculous process present or a simple bronchopneumonia; if the symptoms are less acute and delayed until the period of convalescence from rubeola, tuberculosis should at once be sus-

pected. If in the convalescence from pertussis the symptoms are slowly developed, tuberculosis is indicated.

If the family history is positively clear, no source of possible infection being detected or suspected, and the surroundings all good, a diagnosis of bronchopneumonia is made with good reason, no matter how protracted the affection and unusual its course, provided always, among the features mentioned, that the child was previously healthy.

If the pulmonary affection remains doubtful and meningitis develops, it almost invariably proves the tuberculous nature of the lung condition. Simple meningitis may follow bronchopneumonia, but the combination is so unusual that tuberculosis with secondary meningeal infection should at least be thought of and eliminated if possible.

The development of bronchopneumonia is almost always rapid, while the course of tuberculosis is protracted, the onset preceded by premonitory symptoms, which may last for several days or weeks, fever is more constant, anemia is much more marked, and, what is of most importance in differentiation, wasting is more marked and progressive. Of course, if the presence of the tuberculosis bacillus is determined, then the diagnosis is positive.

Tuberculosis of the bronchial lymph-nodes is generally associated with tuberculous processes in other parts, but at times it exists as the most important and at times the only detectable lesion. The symptoms of tuberculosis of other parts may be insignificant or entirely lacking. But as swelling of the bronchial glands may occur in other diseases (notably in syphilis), even though infrequently, care must be exercised to corroborate the suspicion of a tuberculous cause by other evidences.

The younger the child, the easier does the involvement of the glands become, and when symptoms appear, they are those which are due to pressure principally. If pressure affects the recurrent laryngeal or the pneumogastric nerves, there is more or less hoarseness, dry, persistent, spasmodic cough, and perhaps some facial edema. If the trachea or a bronchus is involved, then dyspnea occurs, usually in paroxysms, and is generally associated with facial edema. During the paroxysm the child may throw the head forcibly backward in a tonic spasm, and give evidence of much

suffering. Pressure over the great vessels adds cyanosis to the picture.

More importance must be placed upon the occurrence of these latter symptoms (cough, dyspnea, cyanosis, facial edema) than upon the physical signs, which are unfortunately complicated by the large size of the glandular swelling. As not a few of these cases are first seen by the physician because of the laryngeal symptoms, and because in several instances the signs of tuberculosis are insignificant, care must be exercised to eliminate all other cause of laryngeal stenosis (see page 85).

Tuberculosis of the brain is almost invariably a secondary condition, so that the diagnosis is usually made when its general symptomatology is understood, because one is naturally on the lookout for its occurrence. The symptoms depend largely upon the size and number of the tubercles, and if very large, then there are added the evidences which are observed upon the exterior of the skull (enlargement) or upon the eyeball (protrusion).

The general symptoms are due to cerebral irritation, so that in a child who has been previously affected with a tuberculous process, we may observe more or less restlessness, stupor, or delirium, associated with attacks of vomiting or nausea, disorders of the cranial nerves, visual disturbances, motor or sensory paralysis, or incoördinations, etc.

These at once lead to a suspicion of secondary infection, and by the application of the usual methods of cerebral localization, the lesions are usually more definitely located. As vomiting is an early symptom, if it occurs without apparent cause during the course of tuberculosis, it should arouse suspicion of meningeal involvement. Many times vomiting and some gastro-intestinal disturbance will persist in a mild form for several days as the first symptom, and unless one is upon his guard and notes the apparent lack of cause and mildness and persistence of the disorder, he will treat it as a digestive disorder, much to his chagrin later on.

Within a week or two following such symptoms the child becomes gradually worse, with marked cephalalgia and irregular temperature, but at the same time with a pulse which does not increase in ratio as the temperature is elevated. Then follows a period in which the child is either listless or irritable (these may alternate),

with a tendency to somnolence which may be marked. The whole condition steadily grows worse, the respiration becomes irregular, and the skin so sensitive that redness may be caused by the slightest pressure (the latter is not a constant feature, however).

There finally occur rigidity of the musculature of the neck, retraction of the abdomen, more elevation of the temperature, inability to take nourishment, paralyses, Cheyne-Stokes respiration, prostration, and probably terminal convulsions. The whole course may run but a few days or may be prolonged to several weeks, but in younger children the shorter course usually obtains (for a detailed description see page 403).

An involvement of the peritoneum as a primary affection is rare, but it does occur. For the purposes of diagnosis it is only needful to recognize two forms of the affection—the plastic and that which is associated with ascites.

Sometimes there is an indefinite period in which diarrhea or constipation, or the alternating of the two, may exist, and be associated with indefinite abdominal pain. Such a condition naturally leads to the suspicion of some gastro-intestinal disturbance, and usually it is not until considerable enlargement of the abdomen has taken place that the correct diagnosis is made. When enlargement takes place, the abdomen assumes a more oval shape, on account of compression at the sides and the tension of the walls.

This form of the disease is much commoner than is generally supposed, and is the chief cause of ascites in children who exhibit moderate elevations of temperature. Palpation of the abdomen shows that it is sensitive and swollen, and tender glands may be distinguished, as are also matted masses of the intestines and the peritoneum. If the case is one which does not go on to purulent degeneration, the course of the disease is prolonged indefinitely, with alternate periods of improvement and decline (for a detailed description see page 138).

In all parts and organs of the body, except the lungs and intestines, a tuberculous process is usually secondary, so that the diagnosis is thereby simplified, but it must be distinctly remembered that primary affections of other parts and organs do occur, although this is not the rule. We have up to this point considered the more acute forms of the disease, and before taking up a more

chronic form which is most observed in older children, I wish to refer the reader to two other sections—that dealing with "Tuberculous Meningitis" (page 403) and the one on "Tuberculous Disease of the Bony Structures" (page 460).

Chronic pulmonary tuberculosis is very infrequent in young children, because their resisting powers are such that they succumb to the disease before the process is far advanced. But with older children, who are better equipped to withstand the ravages of the disease, a chronic pulmonary tuberculosis is not uncommon. Usually it is observed after the seventh year of life. There is a pathologic difference as to whether the disease begins as a chronic condition or is developed from an acute attack, but clinically there is no distinction; the result is about the same in both cases.

While every portion of the lung may be affected, the resulting cavities from the breaking down of the caseous nodules have usually a central location. The symptoms may not be markedly distinctive when taken separately, but the usual picture is that of successive stages of bronchitis, bronchopneumonia, and abscess formation, and the usual course is one of periods of improvement followed by periods of retrogression. With the progress of the disease the anemia becomes much increased in degree, the child fails progressively in strength, night-sweats occur, and the slightest cause is usually sufficient to bring about various serious disorders. The gastro-intestinal tract is particularly liable to disturbances from slight causes.

The temperature is irregular, following somewhat the activity of the process, and the complications and the respiration and pulse show a similar tendency. The sputum is not usually abundant and does not become purulent until late in the disease, if at all. Physical signs are deceiving: deep-seated cavities are hard to distinguish; superficial ones may be suspected and yet the true condition present may be a superficial bronchus or bronchiole; the respiration at times is but little disturbed.

I have purposely left the consideration of the diagnosis of most of the varied forms in which tuberculosis appears in children until this time, for there are many features which aid in the diagnosis

which would have to be repeated and repeated unless taken up collectively. Some differentials have already been discussed.

The diagnosis of tuberculosis in young children depends mostly upon the characteristic symptomatology, and the one who has this most clearly fixed in his mind will be the one most likely to make an early and correct diagnosis.

An inquiry in detail into the family history of the patient, of his previous history and surroundings, and of the fact as to whether or not he has suffered from any disease which is liable to be followed by tuberculosis, is of absolute and of great importance in the diagnosis. And while speaking of the diseases which are often followed by tuberculosis, I may state that it most frequently follows the catarrhs which accompany rubeola, pertussis, and influenza; it seems to be the catarrh rather than the disease itself that offers the favorable ground.

Next in importance is the examination of the sputum, if it can be obtained; and if not, then there is usually sufficient material brought from the throat by the act of vomiting to allow of an examination. Generally speaking, tuberculous processes attack the upper parts of the chest in preference to the lower portions, but this is not uniformly so. It is really only in the commencement of the disease that much doubt exists, and careful observation, corroborated by a carefully taken and complete history, usually soon clears up the difficulties.

SCROFULOSIS

Scrofulosis might well be defined as a general state of malnutrition with a marked inclination to the occurrence of chronic inflammation of different tissues and organs under the influence of the slightest irritation. There is one quite constant feature of the condition, and that is that the neighboring lymphatic glands are almost invariably involved, and remain enlarged for a very long time after the subsidence of the primary cause of the inflammation. The age at which the symptoms first show themselves is usually between three years and ten years, and the situation, the cervical glands. Scrofulosis is essentially a disease of childhood, for after the time of puberty a subsidence of all symptoms is characteristic.

The glandular swellings are the first signs of the disease, and this may occur very gradually. If there is a hyperplasia, then each gland may be palpated singly, but when caseous degeneration takes place, the glands are larger and coalesce, so that the contour of the part is partly destroyed. Very frequently the enlargement is not progressive, but shows distinct periods in which improvement or arrest takes place. The skin may show signs of an obstinate eczema or impetigo, and the eyes be affected with conjunctivitis, keratitis, etc.

When the cases are of the rapidly developing type, the glands which are affected attain a considerable size within one to three months, and at first are movable and clearly defined. As degeneration occurs, this distinctive outline is lost and they become adherent, first to the deep structures of the part and then to one another. When softening takes place, there is distinct fluctuation and the skin over the glands becomes discolored. Rupture results in the outpouring of thick pus.

In the slowly developed cases the glands are usually adherent to each other, but not to the deep structures. They are covered with normal skin, for suppuration is not the rule.

It will not be necessary to mention all the conditions which

arise as the result of scrofulosis: the statement made at the first part of this section is sufficient to show that almost innumerable conditions may be present, for scrofulosis is a malnutrition with tendency toward all kinds of inflammation.

The diagnosis is not always easy, for not all cases show a decided involvement of the glands, and many other conditions do. In false and in true leukemia the glandular swelling which occurs is much more general and pronounced, besides being more painful. In true leukemia there is a marked chronicity, with marked pallor of the skin, enlarged spleen, and an increase in the white corpuscles.

In late hereditary syphilis (that is, in cases in which the symptoms have been so slight during the first year as to be overlooked) the symptoms are very similar, but their character differs, as does the history also. However, one must be guarded in taking a syphilitic history, denials are so frequent, and the parents might be all right at the time, but affected at the birth of the child.

There may be considerable inflammatory rhinitis in scrofulosis, but in syphilis there is a chronic ulcerative rhinitis with destruction of the septum. Periostitis of the bones of the leg is common to syphilis, but synovitis of the small bone joints is the rule in scrofulosis.

Gummata and ulcers with clean-cut edges are evidence of syphilis, while in scrofulosis there may be at times nodes in the subcutaneous cellular tissue, the favorite situations being the buttocks, thigh, and cheek. Then of immense value in the differentiation is the result which is obtained by appropriate treatment.

Scrofulosis is often confounded with tuberculosis, but that they are not identical is shown by the good effect of treatment upon scrofulous children, by the occurrence very commonly of cases in which the other members of the family are perfectly healthy, by the absence of the tuberculosis bacillus, and the tendency to complete recovery at the time of puberty. That scrofulosis offers a very favorable ground for the development of tuberculosis is granted, and, in fact, the inflammatory products of scrofulosis are unstable, and, accumulating in some organs, may in time bring about an actual tuberculization.

RACHITIS

This disease is essentially dietetic, with hygienic conditions being an important factor, and it belongs to the first three years of life. The disease does not spare the nursing child, if that act be unduly indulged in, and so we encounter it in nurslings after the first year or a little more, when all other nourishment but the breast milk has been denied the infant. The usual time for the manifestation of the first symptoms is between the sixth and the fifteenth months, although there are congenital and late cases.

Fig. 122.—Rachitis. This figure is illustrative of a child of fifteen months, who is a victim of rachitis. The parents noticed nothing wrong with the infant, except that he walked "bow-legged," and it remained for the medical attendant, who was called in to see another child, to make the diagnosis and point out to the parents other evidences of the condition. The deformities, which were becoming quite evident in this case, are well illustrated in figures 123 and 124. Note the pendulous abdomen in this figure.

There are many things which may lead one who is experienced in observing a large number of children to make an early diagnosis, or to predict the occurrence of the disease, unless conditions are changed. Thus, we know that if a chronic state of dyspepsia occurs early in life, no matter what the manner of feeding the infant may be, rachitis is almost sure to be evidenced later on. If an infant is fed upon some one of the proprietary foods or upon condensed milk, and nothing else is added to the dietary, we are safe in predicting the occurrence of the disease.

Sweating of the head, and especially as the child sleeps, may be

the first indication that there is something wrong with the child. Baldness of the occiput has the same value as a diagnostic sign. Unfortunately, these cases are usually not seen early, and then one has to depend upon the previous history of the child. When this is obtained, we usually find that for months previously the infant has been restless at night, has been constipated, sweats about the head (and therefore is easily subject to attacks of rhinitis), or is bald at the occiput and is anemic.

I have found in most of my cases anemia and a flabbiness of the

Fig. 123.—Rachitic deformity.

Fig. 124.—Rachitic deformity.

musculature as the earliest symptoms. The first appreciable bony change is that which occurs in the ribs. It is known as beading of the ribs and as the rachitic rosary, and consists of the formation of nodules at the junction of the costal cartilages and the ribs. Sometimes it is very slight, and remains so even when the case is severe, but in other instances it is very prominent. Most of the slightly developed rosaries are explained at autopsy, when it is found that the nodules are upon the internal surface mostly.

If the infant be under six months, craniotabes may be present. These are soft spots in the cranium, which are generally situated over the occipital or posterior portions of the parietal bones, are from one-quarter to three-quarters of an inch in diameter, and upon pressure give to the examining hand a sensation like the crackling of parchment under the fingers. After six months craniotabes are very infrequent. The head soon appears to be out of proportion to the size of the body, and an actual enlargement may take place as the result of thickening of the frontal and parietal protuberances. The result is that the head assumes a somewhat square shape, being flattened at the occiput and vertex. The closure of the fontanelle is delayed in rachitis, but hydrocephalus must first be excluded as a cause.

Fig. 125.—Rachitic deformity.

Softening of the ribs is soon evidenced by the loss of the normal shape of the chest; the normal curvature of the ribs is lost and they become straighter. The chest then appears to be more or less compressed laterally, and the sternum is forced forward.

There is an almost constant fermentation going on in the intestine, and the abdomen becomes quite distended. This abdominal distention finally extends until all portions of the abdomen are involved and the lower portion of the chest below the point of insertion of the diaphragm is affected. The result of such distention is that a groove is formed which divides the upper and narrow part of the chest from the lower and distended part, forming the rachitic girdle.

Fig. 126.—Genu valgum. Female child five years old (Napier).

The characteristic bony changes in the long bones of the body are thickening at the lower ends of the forearms, so that the wrists seem to be enlarged. The general softening of the bones naturally results in

more or less deformity and the legs are the subjects of various curves.

The rachitic child is notably weak in the muscles, and this is so marked at times that the little one will not attempt to walk and at times cannot even assume an erect position. Following the law of gravitation, the body is bent so that the spinal column is arched with the convexity backward. The curvature of the spine which occurs in rachitis is general, in contradistinction to the localized curvature of Pott's disease. Rotary curvature is much less common. The ligaments, and especially those about the large joints, are very lax and lead to more or less deformity. Muscular power may be so weakened and the ligaments so lax as to suggest the presence of paralysis.

Fig. 127.—Deformity from rachitis (Napier).

The rachitic infant is notably the subject of an easily deranged digestive system. The gastro-intestinal tract fails to perform its functions properly, so that there is an inclination to diarrhea or constipation, and always to chronic meteorism. The respiratory organs also show a marked inclination to chronic or oft-repeated catarrhs, so that the child is constantly in danger from the occurrence of serious disease.

The nervous symptoms are many and varied. Restlessness at night, as has been stated, is one of the earliest. Attacks of laryngismus stridulus, tetany, or general convulsions are not uncommon, and of the first two of these it may be said that they occur most frequently in rachitic children. The susceptibility to the occurrence of general convulsions is very marked in the child affected with rachitis, so that the slightest causes will bring on an attack.

In each case, of course, all the associated symptoms will differ: in one infant it may be the mucous surfaces which suffer most, in others the respiratory apparatus, the nervous system, or the diges-

tive system, and the manifestations of the disease depend somewhat upon the age of the infant and its surroundings. The duration is months, for the disease is essentially chronic. Active symptoms usually continue for from two to fifteen months, but may persist for a longer period.

It is only during the early stages of development that the diagnosis is at all difficult, and even then, after taking a history of the previous condition of the infant, and particularly in regard to its nourishment and surroundings, there is practically no chance for error in the diagnosis of the disease.

All the early symptoms (anemia, restlessness at night, head-

Fig. 128.—Flat foot.

Fig. 129.—Talipes calcaneus.

Fig. 130.—Talipes equinus.

sweating, baldness of the occiput, craniotabes, enlarged fontanelle, delayed or difficult dentition), taken singly, may mean something entirely different than rachitis, but, taken together, or when most of them are present at one time, they can mean nothing else but this disease.

It is the undue prominence of separate symptoms which occasionally causes the trouble. There may be a slight involvement of the bony structures, but a most pronounced anemia associated with a large and solid spleen, so that the question as to a complication, leukemia, being present is at once suggested. Microscopic examination of the blood will at once determine this point. The enlargement of the head may be such as to suggest hydrocepha-

lus, but in either disease there are other symptoms peculiar to each which are soon evident upon examination.

The musculature may be prominently affected (particularly of the legs) and the bony changes slight, and such cases offer much similarity to actual paralysis. A study of the electric reactions will at once determine the question in regard to infantile spinal paralysis (page 361), and the presence of more or less marked cerebral symptoms, exaggerated knee-jerk, and spastic paralysis of the legs will be sufficient to distinguish a cerebral birth-palsy.

Fig. 131.—Talipes valgus.

Fig. 132.—Talipes varus.

The possibility of mistaking syphilis is rather remote, for in the beginning the lesions of syphilis are more like soft infiltrations over the bones, and the part affected is not the end, but the junction of the shaft and the epiphysis, or in later changes the shaft of the bone is affected. The history of the two diseases is markedly different. Bone changes are early in rachitis, but in syphilis they occur, as a rule, late in the second year, and the skull is not affected.

HEREDITARY SYPHILIS

Hereditary syphilis must not be confounded with the acquired form, which in its course and various phenomena does not differ in any marked particular from the acquired form of adult life. An inability accurately to make a distinction between the two forms may result disastrously to the reputation of a faultless person.

Snuffles, pemphigus, and pseudoparalysis are never found in the early acquired form in children, while the occurrence of a chancre, no matter what its situation, settles all uncertainty as regards the disease being acquired. In addition to this, the presence of Hutchinson's teeth and the peculiar claw-like appearance of the nails are strong evidence in favor of the acquired form.

A child may readily become inoculated with the disease by kissing a person with such syphilitic manifestations as mucous patches, fissures, and ulcers, or acquire it from a nurse who is syphilitic. The possibility of vaccination as the mode of inoculation has to be thought of, for in a few sections the humanized virus is still used. Criminal assault is not an unusual means of infection, and it is in just such cases that the utmost skill and precaution must be exercised to distinguish between the hereditary and the acquired forms.

No matter how young the child may be, a somewhat typical course of the phenomena of syphilis, following the appearance of a chancre, or primary adenopathy, is the only substantial proof which we have that the case is one of acquired syphilis.

Not alone in making a distinction between the two forms, but as a matter of direct diagnosis of the disease, the family history is a very important matter. It is usually very difficult to obtain a perfectly satisfactory history, for parents will either wilfully deceive or make misstatements through ignorance. In taking a history there are several points which it is well to consider:

(*a*) The tendency of the children of a family to suffer from unaccountable anemia and malnutrition during early life is very suggestive. Several children of the family may be so affected, despite the fact that the hygienic surroundings and the dietetic care

are both excellent. Briefly stated, the situation is simply this: if two or more children in a given family are affected with anomalous or unusual types of disease, and the cause of such is not well defined, a strong suspicion of hereditary syphilis should be entertained.

(*b*) Delayed development without apparent cause, or occurring from very slight causes in two or more children of a given family, should arouse a similar suspicion as to the cause.

(*c*) The occurrence of a rachitic type of skull, without the other signs of rachitis being more or less marked, is suggestive of hereditary syphilis.

(*d*) A history of the abortive habit in the mother will at once suggest the possibility of an underlying syphilitic taint.

Late hereditary syphilis occurs as a relapse of an old syphilis, the early symptoms having been attributed during early life to some other cause, or having been so mild at that time that they were neglected. With our present knowledge of the disease I believe that we are justified in accepting this as the explanation of the occurrence of these apparently late symptoms. They are usually those of the tertiary period, and are most frequently observed during the time between the fifth and tenth years, but may appear early or late in rare cases.

The symptoms are numerous enough, as a rule, but are far from being characteristic, so that the family history becomes a very important factor in the diagnosis. Such a history may be very indefinite, and much patience must be exercised to bring it out. To be of service, it must establish the fact that syphilis has occurred in the family.

Methods of Acquisition.—Can the father alone infect the child? This question has not been satisfactorily answered up to the present time. The great uncertainty is, whether the child can be affected at all without the father first infecting the mother. No doubt the father may hand down to his offspring certain conditions which, while they are not purely syphilitic, yet are derivatives of that disease, and the result upon the infant is that it presents unusual perversions of development, of nutrition, and of mentality which are accounted for in no reasonable way. This fact is impressed very strongly by the birth of a much weakened type of off-

spring, which are the product of apparently healthy mothers who have husbands who are syphilitic. The result of specific treatment in these cases is their rapid improvement.

Does the mother infect the child? It cannot be too strongly stated that if the mother at the time of conception is syphilitic, the offspring will surely be. In the mean time the father may remain healthy, as the power of the woman to infect the child persists for a longer time than her power to infect the man.

If both parents are healthy at the time of conception, and the woman becomes infected later, will she transmit the disease to the child? This is a much mooted question, but there seems to be abundant evidence to prove that up to the seventh month of pregnancy, if the mother becomes infected, the child inherits the disease.

It is rather rare that a woman in full syphilis and pregnant does not abort. Active treatment has apparently no effect in checking this tendency. The cause of such an abortion is usually the death of the fetus. It may be blighted early in the pregnancy or there may be later shrinking with subsequent death. Generally there are serious visceral changes and abnormalities which occur to destroy life. Changes in the placenta are very common, affecting the life of the fetus and giving rise to profuse hemorrhages from partial detachment.

The syphilitic child at birth may be rather shrivelled looking, on account of the lack of fatty tissue in its body. The face generally has a characteristic pinched look, and very shortly after birth the expression is like that of an old man, and this becomes more and more noticeable as the infant ages. The infant may be covered with bullæ from which the epidermis slips, leaving areas which are denuded, or blebs may be found upon the palms and soles only.

Usually the birth is premature, with all the consequent train of symptoms. The usual dusky color of these infants is due to the general vascular tone being defective. The lesions may be present at the time of birth, but this is very unusual, for they rarely develop until the third week or later. Excoriations of the quasi-mucous surfaces about the anus, the mouth, and the genitals are very common, and especially so of the anus.

Snuffles develops almost invariably and is an early occurrence, in many cases being the only symptom for a long time which attracts

attention to the existence of syphilis. Occasionally it occurs without any nasal discharge, but usually this is more or less abundant (of mucus) and may at times be tinged with blood. In rarer cases there is an epistaxis which is frequent and associated with no other discharge from the nose. There is one marked characteristic of the nasal discharge—if it once occurs, it is persistent.

The occlusion of the nose may be so great as to interfere seriously with respiration and also the act of nursing. Frequently the discharge from the nostrils is very irritating; this, however, should not lead one into the error of assuming that the sores about the mouth are due to the nasal discharge (this has often been done and the diagnosis not made until some time later). The skin is thick and swollen at times.

Not infrequently there appears a livid eruption which is macular and with well-defined borders, and affecting the skin especially about the genitals and face. The maculæ are bright red in the beginning, but become more of a brownish color in time, and are followed by some desquamation, which is most marked upon the soles and palms.

At other times there is a peculiar eruption which is almost identical in character with pemphigus, consisting of bullæ or blebs. These are filled with fluid which is slightly turbid and bloody, or the contents may be pus. When rupture takes place, the contents dry into a greenish crust and ulceration goes on underneath. The blebs are not numerous—in fact, there may not be more than three or four at most, but they are strongly diagnostic of syphilis. The usual situation is upon the soles and palms. The nails are dry and brittle and pustular onychiæ in the matrix are common.

The bridge of the nose is broader than usual and lower also; if much necrosis has occurred, it may be much sunken. The forehead is generally large and protuberant, and there is frequently a well-defined depression just above the eyebrows. The hair is not so apt to be involved, except that it is brittle and scanty and there may be patches of alopecia.

The teeth are erupted late and show early decay. The changes in the teeth are many; all the teeth or only the middle incisors may be abnormally small, and slits remain between the teeth. In other cases they are covered with a false enamel which rapidly

crumbles, allowing the teeth to rot and decay. On the surfaces of the teeth there are frequently calyciform and transverse striated erosions which are sometimes single, forming a groove. Such changes in the teeth occur most often in hereditary syphilis, but are not limited to that disease alone, so that they must not be considered anything more than suspicious. Particularly characteristic of syphilis is the presence of Hutchinson's teeth; these are characterized by the semilunar notching on the free edge of the two upper middle incisors. Besides this, the teeth are short, narrow, and have rounded corners.

The bones, the cartilages, and the articulations show characteristic changes in both early and late hereditary syphilis. The most frequently affected portion of the skeletal structure is the diaphyso-epiphyseal junctions of the long bones, and especially the tibia. In syphilitic osteitis in infancy the bones are more or less uniformly enlarged, but suppuration or necrosis is very infrequent.

Of the long bones, the tibia is the most often affected, or there may be a simultaneous affection of several of the bones. The appearance of the tibia is saber-like, for the bone has the look of being compressed at the sides and has an apparent arch forward. This arch is, however, only apparent, for there is no actual curve, the appearance being due entirely to new-formed osseous tissue on the anterior surface of the bone. If this point is not well understood, there is danger of mistaking the deformity for a rachitic curvature; but in rachitis there is a definite curvature and not simply a unilateral thickening, and this occurs when the child begins to stand or walk.

The new bone deposit of syphilis is the result of a specific periostitis, and this is very painful in its beginning, the pain being prominent long before any other symptoms appear and being much worse at night. When the thickening appears, the pain disappears. Such a course (from the earliest appearance of pain to the formation of thickening) may occupy a period of four months or four years. In a few instances the pain is only elicited upon handling the child.

Gummata are very common, appearing with greatest frequency on the anterior aspect of the bones of the leg and the skull. They are half spherical, limited swellings and are quite painful. In the

beginning they are solid, but later there is distinct fluctuation, and about the same time they become more or less adherent to the skin. They are of varied sizes, from that of a pea to that of a small apple. Ulceration may take place.

The various bone lesions are readily mistaken for scrofulosis. In the latter, however, it is the short bones that are most often affected and the epiphyses of the long ones. Caries is very apt to occur as the result of tuberculous infection. The pain during the whole course of scrofulosis is exceedingly slight, or more often absent altogether, and the bone itself is not enlarged (the swelling is due to edema and infiltration of the soft parts) and there is a doughy feel to the tumor.

On the other hand, during the course of hereditary syphilis, the long bones are the ones affected, and the enlargement is of the bone itself; pain is usually marked in the beginning and the tumor is solid and unilateral (that is, it occupies but one side of the bone).

Interstitial keratitis is quite pathognomonic of hereditary syphilis, and when associated with the appearance of syphilitic teeth, it places the diagnosis beyond all doubt. The origin of such a keratitis is usually ascribed to malnutrition, but it is present in hereditary syphilis more often than in all other conditions put together. It is evidenced by a diffused opacity of one or both corneas and develops slowly and without any signs of irritation. The duration is from six to twenty months, and the final result may be a few scarcely visible spots which remain, or there may be a perfect clearing. When such a keratitis, Hutchinson's teeth, and deafness are associated together, they constitute what is called "Hutchinson's triad." Deafness is particularly indicative of syphilis if it occur without pain or a discharge of pus.

The visceral lesions are by far the most important. This can be readily understood, for the processes of nutrition and growth in infancy are most active, and this of itself favors constructive change. The result is that the proliferation of new connective tissue about the parenchyma of any viscus is favored. Such interstitial proliferations are usually wide-spread, and any or all of the viscera may be involved in the process, but particularly liable to such conditions are the liver, the spleen, and the kidneys.

Hemorrhagic effusions in all situations are common in the young

infant, and especially of the meninges, so that it is not uncommon to find cephalhematoma occurring in these cases. Under the influence of prolonged or difficult labor, intracranial or subpericranial effusions are common.

In its influence upon the nervous system the disease may act in various ways:

(*a*) It may so affect the nervous system of the fetus as to markedly interfere with normal development. This is generally evidenced by an arrest of brain development, which is responsible for many of the instances of idiocy which occur.

(*b*) Lesions which are identical with those of the acquired form may be present in the new-born or occur shortly after birth. Then, again, they may not appear until later in life, but after the seventh year lesions of the nervous system become rarer.

Evidences of an anomalous or unusual involvement of the nervous system by disease should stimulate a search for evidences of syphilis in the child. The reason why in one case we obtain many evidences of involvement of the nervous system, and in another case very few, is probably explained by the differing neurotic histories of the children and the influence of traumatism, which seems often to determine the development of certain neuroses.

THE BONES AND JOINTS

As landmarks the bones and joints of young children are not of as much value as in adult life. Usually they are well covered with tissue and cannot be so easily made out. It is quite necessary, however, that one familiarize himself with the normal conditions, for the bones may be the seat of nutritive changes which will influence the skeleton, and therefore the body.

The position of the bones in some instances may be influenced by the occurrence of paralysis. Nodules or nodes may be present, and are usually due to traumatism, to infection, or to syphilis. In the latter disease the favorite situation of such is upon the cranial bones or the shafts of the long bones, and they are generally bilateral or multiple. They are accompanied by tenderness and usually by marked pain, but are not so hard as exostoses.

Then the joints, both large and small, may offer many deviations from the normal conditions. A swollen joint may suggest many conditions—may be due to injury, as in fracture, or to hereditary syphilis or rheumatism. If we observe in a child that the wrists and ankles are symmetrically enlarged, it is strongly indicative of rachitis. If there is an increasing swelling, with tenderness which is at times extreme, resulting in the child crying every time that any attempt is made to move it, it is indicative of scurvy.

Swollen joints may also be due to acute arthritis of infants. It is important to note whether the affection be limited to one joint or affects several. When a single joint is affected, the process may be a local one and due to traumatism. But when several joints are involved, then we at once suspect a general infection, with some disease, such as rheumatism or tuberculosis.

An affection of one large joint indicates an injury, rheumatism, or pyemia. An affection of several small joints points to scrofulosis, tuberculosis, or rheumatism, while the affection of several large joints suggests a rheumatic infection.

Then there are joint symptoms which are the expression of some more or less severe general infection, as cerebrospinal meningitis,

scarlet fever, purpura, scurvy, hemophilia, etc. All these are considered under their appropriate and respective headings.

Acute Arthritis of Infants.—This disease has a sudden onset, with such well-marked local symptoms that the diagnosis is usually not difficult. There is at once evidence of pain, and soon there occurs a rapidly developing swelling about the affected joint. This swelling is at first diffuse, for the lesion is deep-seated. Tenderness is generally extreme, and redness, edema, and fluctuation soon supervene. At the same time there have been marked constitutional symptoms, for the disease usually occurs with a chill or convulsion, followed by high fever with wide variations, and accompanied with marked and early prostration. The duration of the disease is from six to fourteen days, with the evidences of pus formation about the fifth day.

The greatest error is in mistaking this disease for rheumatism, a disease which is so rarely manifested in this way in infancy that the error is hardly ever justified. There is certainly much more excuse for mistaking it for syphilitic epiphysitis, although there is a lack of the rapid course which is observed in acute arthritis. When the local signs of the disease are not considered too much apart from the associated constitutional ones, there is but little opportunity for mistake.

Infective Ostitis.—Inflammatory diseases of the bones are frequently associated with the exanthemata, and such an inflammation is an osteomyelitis, but usually with the brunt of the disease falling upon the deep layers of the periosteum. We do not yet know exactly why the changes which take place in the bone are so marked, or just how they are produced. But this we do know, that during the course of the acute infectious exanthemata there is a marked tendency to the occurrence of bone inflammation from slightly active causes.

Acute Osteomyelitis.—A slight injury or the mere application of some irritant to a limb may be sufficient, under favoring circumstances, to cause a vascular disturbance which fits the part as a nidus for the organism which starts the disease.

The initial symptoms are, for the most part, those of a more or less severe attack of septicemia, but in very young children the symptoms are somewhat indefinite and misleading. The infant

or child may be fretful and cross, may refuse any food, and may scream vigorously when moved. But if osteomyelitis is present, it will always be noted that one limb is held motionless, and when an examination is made, it is found that tenderness is acute, the marked tenderness being near one of the epiphyses. Untreated, the joint is soon swollen and inflamed, and an abscess soon bursts into it. Or if the disease run a more favorable course, there is enlargement without abscess formation.

The typical course of the disease is observed most often in children who are over two years of age, and it is not uncommonly observed between the ages of eight and fourteen. Generally it is a poorly nourished or debilitated child who suffers, and the onset is sudden, with convulsions or chill, vomiting, diarrhea, and severe headache. Sometimes the child is so ill that no complaint is made of pain at first, and the symptoms are then misleading. The temperature usually rises rapidly to 105° or 106° F., with morning remissions to 101° or 102° F., but accompanied in most instances with marked delirium. Altogether, it is a picture of acute septic poisoning that confronts us: there are profuse sweating, dry tongue, enlarged spleen, etc.

During the first forty-eight hours the only means of detecting the lesion in the bone is through the experienced touch, and it is usually only after the time for cure has passed that the disease is well made out. It will at once be seen that an early diagnosis is desirable, for it is in the early stages alone that much can be done by treatment.

And, upon the other hand, there is hardly a disease in which more errors are made in the early diagnosis. First we are apt to think of the more common acute diseases, so that frequently the symptoms are ascribed to rheumatism. In considering the possibility of the latter, there are two things to take into account—the family history and the preceding condition of the child (see "Rheumatism").

The dangers of thinking that the symptoms are due to cellulitis, to tuberculous peritonitis, to tuberculous meningitis, and to scurvy are all very real, and it is only by a careful examination of the joints that these can be eliminated.

Fractures.—While the symptoms of fractures in children are the same as in adults, many mistakes are made because they are not so

marked. They differ principally in two particulars: First, the pain in children is inconsiderable when compared with adults and crepitation is never as well marked. The deformity is apt to be very much less also, because the fracture is not so oblique and the musculature is weaker than in adult life. Then, again, "green-stick" fractures are very common to childhood, and inattention to these apparently small details will lead to the most serious errors and the most embarrassing positions.

The healing of fractures in childhood is rapid, the sequels are very few, and the results are good.

Osteopsathyrosis.—Of this unusual condition, in which there is a tendency to repeated fractures, we know but little. The symptoms are those of ordinary fracture, but as slight violence is required to produce the result, there are less bruising, less swelling, and but little pain. It must be differentiated from the spontaneous fractures (epiphyseal separations) which occur in scurvy at times. Hereditary influence is strong.

The diseases of the bones and the joints which are dependent upon the two diseases, tuberculosis and syphilis, are of such import that I have considered them in separate sections, and these follow (see Tuberculous Diseases of the Bones, page 460, and Syphilitic Diseases of the Bones, page 474).

TUBERCULOUS DISEASES OF THE BONES

As far as the tuberculous diseases which affect the bones and the joints are concerned, the very first symptoms are the all-important ones, and the early recognition is necessary to prevent deformity, for when the disease is early defined, much can be done by surgical and mechanical intervention.

The children who are affected almost always have a well-defined tuberculous history, and in many instances a well-defined tuberculous lesion which has preceded. In many of the cases that seem to be of primary origin little care has been taken to elicit the history, and frequently at autopsy antecedent lesions are found which were overlooked during life.

Just as an injury seems to determine the onset of tuberculous meningitis, so traumatism frequently acts as an exciting cause of

tuberculous bone disease and determines its situation. The age at which tuberculous bone disease is most apt to occur is between the ages of three and seven years.

There is generally, at first, a primary ostitis, and this shows a special preference for the articular portions of the long bones. The bones of the spine are the most frequently affected of all bones, and the disease may be located in any of the vertebras. Then, next in frequency, the hip is attacked, and, in the order named, the knee, ankle, elbow, wrist, and shoulder.

Fig. 133.—A method much in vogue of eliciting pain in the spinal column when caries is suspected; by pressure forcibly applied to the head. This method is mentioned only to be condemned as unnecessary, useless, and as liable to cause further injury.

The process which occurs in the bone is somewhat on a par with that which occurs in the tuberculous lung. The duration of the bone disease is from one to ten years, with three years as the average. Abscesses are formed in a large proportion of the cases and may burrow for considerable distances before reaching the surface.

I shall take up the different diseases in the order of their frequency.

Spinal Caries

Pott's Disease.—The onset of Pott's disease is almost always very insidious, so that the disease may have existed for months

without being detected. This happens because the symptoms are usually misinterpreted. The misleading feature is that pain, which is expected, is during the early stages of the disease referred to remote parts (for example, pain in the epigastrium is quite commonly the very first sign which will lead to an examination of the spine by a careful observer, and yet, in most instances, the cause is sought for in the stomach).

With an understanding of the process which is taking place in the bone, one would naturally expect to observe pain, but while it is an early symptom of the disease, it is at first referred to various portions of the body, following the distribution of the nerves which are affected by the process in the bone. The distribution of pain is usually as follows, indicating the situation of the lesion:

Fig. 134.—The stoop of a normal child. Much information may be gained by watching the child as he stoops; if the spine is held rigidly or in an unnatural position, it will at once suggest an examination of the vertebral column.

Cervical disease: Pain is usually located above the site of the lesion, so that occipital neuralgia is common, or there may be pain at the sides of the neck. The pain may be excited only by motion or may be so constant as to result in a changed expression of the face.

Dorsal disease: Pain is below the lesion and may be evidenced as an intercostal neuralgia, epigastric pain, or abdominal pain.

Lumbar disease: Pain is referred to one of the limbs (lower) and may also be referred to the groin, thigh, buttock, or hypogastrium, but referred pain in lumbar disease is not as common as in other forms.

Another constant feature of Pott's disease (besides the pain) is the occurrence of muscular spasm. Muscular spasm depends

largely upon the efforts of the child to limit or prevent motion at the site of the lesion.

Cervical disease: The muscular spasm is commonly evidenced as a slight torticollis or opisthotonos, but the former is the more frequent. Later on, the whole musculature of the neck may be involved in the attempt to hold the head rigidly.

Very early in the disease there may be a tendency for the child to support the head, and the positions assumed by the little one are all aimed at the prevention of motion, although it may be a long time before suspicion is aroused as to the cause for the peculiar positions taken. Generally these children are chastised because of their apparently lazy habits at school and at home.

Dorsal disease: There is much care shown in walking, the spine being held stiffly, and when the recumbent position is assumed or the child arises, it is done with considerable deliberation.

Lumbar disease: The gait is as characteristic as the attitude; the shoulders are carried well backward, the spine held stiffly, and locomotion is stiff with short steps. There is an awkwardness or stiffness in arising also.

Lameness is early and usually coincident with the pain, and at the same time there may be some tilting of the pelvis, with slight lateral curvature of the spine.

Now, when there is evidence of the existence of any of the above symptoms, the examination of the child exhibiting them should be most searching. Nothing short of stripping the child will suffice; we are suspicious of the existence of a deforming disease, and it behooves us to give the child every chance possible to avoid such deformity by our early diagnosis and treatment.

The physical examination has three points in view: (*a*) The detection of deformity; (*b*) to determine the mobility of the spine; (*c*) to detect the existence of secondary abscess or paralysis.

During the early stages of the disease there is only a slight and general curve to the spine, but as the disease advances, then the typical angular curvature occurs.

Cervical disease exhibits a rather late development of deformity; certainly much later than the other forms. The neck appears thickened, and this is so in such a general way that it appears as though the head had settled on the shoulders. In the upper and

the central regions there is frequently an anterior prominence, but to determine this an examination of the posterior pharyngeal wall must be made by the finger. In the lower portion of the cervical spine kyphosis is common.

Dorsal disease usually shows an early but slight lordosis, which later on is displaced by kyphosis associated with compensatory lumbar lordosis. Dorsal disease gives the earliest deformities.

Lumbar disease may be very slow of development in regard to deformity, and it is not unusual to detect an abscess before deformity is marked at all. The compensatory lordosis which occurs with dorsal disease must not be mistaken for disease in the lumbar region.

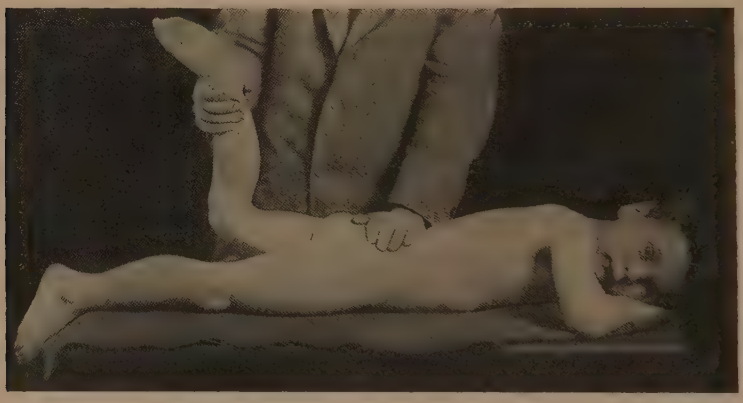

Fig. 135.—Test for psoas spasm. As the limb is gradually elevated by the right hand, if spasm be present, it is felt by the examiner's left hand.

These deformities may be mistaken for deformities which are the result of rachitis. The most characteristic rachitic deformity is posterior kyphosis, but it is general and not localized. Usually it extends from the upper part of the dorsal to the sacral region, and unless it is of long standing, it entirely disappears when strong extension is made upon the limbs or the child is suspended. However, there may be rotary curvature instead, but the former is the most frequent by far. These rachitic curvatures are usually observed in children under the age of three, and there are other and abundant evidences of rachitis present. It may be generally stated that all spinal curvatures occurring in children under the

age of three years are rachitic in origin, or at least due to some malnutrition.

Mobility of the spine may be tested by making the child go through various acts, as stooping to pick up things, getting up from the floor from a sitting and also from a recumbent position, and this may be further studied by attention to the attitude assumed and the gait. The various positions which are assumed in these attempts to do as told is summed up in this fact: that the child endeavors by every means to save the spine as much as pos-

Fig. 136.—Showing the method of determining the flexioility of the spine. In this case it is normal.

sible. There may be, and are, varying differences in the attitudes and motions, which are dependent upon the different situations of the lesion, but the aim of the child is always the same—to limit motion of the spine. By comparison with similar acts performed by a perfectly healthy child, the differences are more marked.

While it is not usually necessary to do so, still at times the nature of the spinal curve may be proved by having the child lie upon its stomach on some hard surface (as a table), and then, by grasping the ankles firmly and raising the body gently, the back becomes

concave. An angular curvature does not disappear under such examination, but rachitic curvatures almost invariably do.

After the mobility of the spine has been thoroughly tested, the examination must determine the presence or absence of abscess formation. When there has been the slightest suspicion of cervical disease, an examination of the posterior pharyngeal wall should be made by the finger, for frequently abscess and deformity will be revealed by this procedure which cannot be detected in any other way.

Occasionally, the very first symptoms which are marked enough

Fig. 137.—Illustrating rigidity of the spine.

to compel the parent to seek advice for the child are those which are due to the formation of a retropharyngeal or a retroesophageal abscess. When suspicion points to an involvement of the lumbar region, deep palpation may reveal the presence of a psoas abscess, but even before the signs of such a tumor are sufficient to be made out by palpation, passive motion of the thigh is accompanied by marked resistance to extreme extension.

Before leaving the discussion of this part of the examination, it may be well to mention some errors that are commonly made, so that, being warned of such, one may be more guarded in the examination. Psoas abscess may be found deep in the iliac fossa

or at the upper, inner aspect of the thigh, and has been mistaken for one of the following conditions: perinephritic abscess and hernia. Because of the stiffness of the muscles, the pain, and perhaps the lack of a clear history, the cases are often treated as rheumatism. Lameness at the hip is very frequently the result of a psoas abscess, but is commonly attributed to disease of the hip-joint, but in the latter resistance covers all motions, while in lumbar disease extension is alone rebelled against.

The formation of abscesses usually occurs during the second

Fig. 138.—Rotary lateral curvature of the spine. Female aged nine years.

Fig. 139.—Rotary lateral curvature of the spine. Female aged nine years (Napier).

year of the disease, but they may not be delayed so long, for in some instances they are found within five or six months from the time of the first symptoms. Such abscesses may occur with somewhat acute symptoms, but this is very unusual, the typical formation being a cold process.

Hip-joint Disease.—There are three rather well-defined stages of this disease: the first an ostitis, and the second an arthritis, while the terminal stage is one of breaking down and absorption.

The first stage of ostitis may last only a few weeks or may persist for two years, with the average duration being four months, being followed by the stage of arthritis, which is also of indefinite duration, but which usually lasts for several months, and the third stage, which persists generally for years.

It is the early recognition of the first stage that is of prime importance, the onset of which is usually very gradual. The symptoms which are first noticed are generally lameness and some disinclination to walk on account of tenderness. These symptoms may persist in a mild degree for weeks, and are so trivial that they are usually neglected or misinterpreted, and it is only their persistence which attracts much attention. At first the lameness is noticeable only in the morning upon arising, and becomes much less during the day.

Fig. 140. — Lateral curvature of the spine (Napier).

Soon the child complains of pain, and this is referred to the knee or to the hip. Such pain may have nightly exacerbations, but this is not always the case. Probably the pain is dependent upon stimulation of one of the articular branches of the obturator nerve. In any event it increases in severity, so that in time there are characteristic "darting pains" which occur at night and are so strongly indicative of hip disease.

Up to this point in the development of the disease there is great danger of mistaking the condition for a strain of the joint, for muscular rheumatism, osteomyelitis of the femur, poliomyelitis, or caries of the lumbar region. The only method of avoiding such mistakes is by taking a careful history of the development of the symptoms; in every instance they are then distinctive enough to allow of no error.

As the disease progresses the lameness, which was at first transient, becomes a steady feature and an increasing one. Instead

of being restless at night only, the child is now fretful and restless during the day also, until the first stage of the disease merges into the second stage of arthritis.

If every child with lameness and tenderness was stripped and thoroughly examined before an opinion was expressed, many mistakes would be avoided. The suspected hip should be compared with the healthy one and the general contour noted, also the presence or absence of corresponding depressions and prominences. Quite early there may be a change in the hip's contour and the whole gluteal region is found to be flattened and broadened. The trochanter may be unduly prominent and the gluteal fold shortened, or single in place of being double. When the limb is measured there may be shortening, but in nearly every instance there is atro-

Fig. 141.—Examination of hip.

phy of the thigh, so that the measurements are less, and the same is commonly true of the calf of the leg.

After the examination just described, the child should be placed upon its back and every possible movement of the joint examined, proceeding, as before, by comparison with the sound limb. Usually motion is limited in all directions, and this is bound to be so if the disease has persisted for a long time. Or if of very long standing, no motion at all is obtained. If the articular surfaces are crowded together, pain is the result; but I believe that in most cases it is not the only result, for considerable injury may be done, and the procedure is rarely, if ever, justified.

Then the gait and attitude must be studied. In walking the child favors the diseased joint, and throws the weight of the body

as much as possible upon the sound limb. In standing the diseased side is also markedly favored.

In the second stage the limb is permanently deformed. There are usually an eversion of the foot, flexure and outward rotation of the

Fig. 142.—Method of testing extension and flexion of the lower limb.

thigh, and apparent lengthening, but if the limb be adducted, there may be apparent shortening so that it is necessary to measure in every case. There is no motion of the joint at this stage. Abscesses may form at almost any point.

In the third stage the deformity is very marked, resulting from

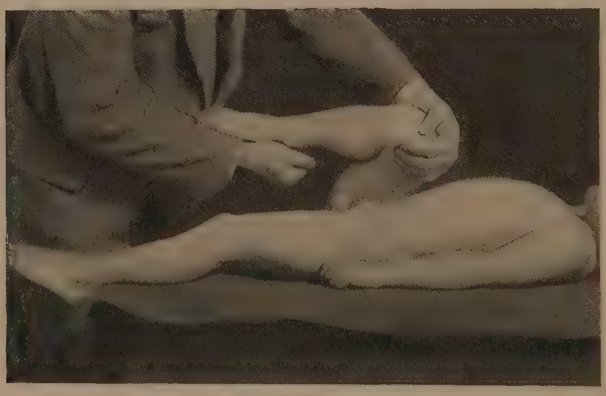

Fig. 143.—Testing the rotation of the hip.

muscular spasm after the ligaments and bone have been absorbed. The position is similar to that which is observed in dislocation upon the dorsum of the ilium, so that there is considerable shortening, the thigh is strongly flexed, adducted, and with an inward rota-

tion. The foot is inverted. All this usually occurs gradually, but it may have rarely a sudden occurrence. Muscular atrophy is marked, and the position of the limb leads to certain compensatory changes to enable the child to stand and maintain an equilibrium. Lordosis and some degree of lateral curvature are generally the result.

As has been stated, the symptoms are so characteristic after the first stages that there is then practically no chance for mistakes.

Knee-joint Disease.—This disease usually affects children between the ages of three and six years and is generally attributed to some injury. I mention this because so frequently the only history is that an injury was received and the child has kept the knee bent slightly ever since and walks with a slight limp. Such is the early history of knee-joint disease. The little one does not usually complain of any pain in the beginning, but limps because the knee is bent.

The great danger at this point is to consider the symptoms as due to injury, to synovitis, or to rheumatism. The history is usually distinctive enough to differentiate all of these except the first, and that requires the most careful consideration.

The affected joint is usually considerably warmer than the corresponding joint. The outlines of the joint are fuller than they should be normally, and this is particularly noticeable upon either side of the ligamentum patellæ, so that the natural depressions are lost. There is wasting of the limb both above and below the joint, and usually some slight fluctuation in the joint. In some cases fluid collects in a large quantity, but does not interfere with function.

Ankylosis, with the limb in a state of triple displacement-flexion, external rotation, and backward displacement of the tibia, take place when there is simple infection or suppuration.

Ankle-joint Disease.—The symptoms are those which are common to all tuberculous joint diseases. In addition there is a swelling which is marked upon either side of the tendo Achillis. The child is capable of walking considerable distances, but does so with a limp, on account of the limited joint movement. Such a limitation is noticeable at first only under extreme flexion or ex-

treme extension. The joint is usually hotter than its fellow, pain in not marked, and the leg is wasted, as a rule.

Elbow-joint Disease.—This comes on very insidiously, because the pain and the functional disturbance of the joint are both very insignificant in the beginning. Usually the first thing to attract attention is the occurrence of swelling at the back of the joint, but this very soon extends around the joint, so that shortly a typical oval tumor is developed. Complete extension soon becomes an impossibility.

Wrist-joint Disease.—In young children this is rare, but as the child approaches puberty it is more common. The disease comes on insidiously, usually involving the whole of the carpus. The joint becomes full and smooth in its outline, on both the palmar and the dorsal surfaces, and there is little difficulty experienced in extending it, although the hand is never used as freely as in the normal joint. Unfortunately, sinuses are usually formed, and generally quite early in the disease. The tendons and sheaths are generally involved in the tuberculous process also.

Shoulder-joint Disease.—In some instances this runs its entire course with so few and so insignificant symptoms that ankylosis results without the child ever having given evidence of being very ill. In other cases the function of the joint is markedly affected, and there are internal rotation and adduction of the arm. Suppuration readily takes place and the abscess burrows downward along the biceps tendon in most instances. Pain is rarely a prominent symptom.

Sternoclavicular Joint Disease.—In this pain is the early and the most prominent symptom, and is usually so acute that the child will assume a position which suggests a broken collar-bone; the elbow is instinctively supported, so that the weight is taken off the arm, and the head is inclined toward the affected joint. It is not long before the rather typical swelling appears over the joint; it is oval in shape, with the long axis lying parallel to the clavicle. While the skin over the tumor is healthy, it is distended, and usually is marked with enlarged veins. The tumor has a doughy feel.

Sacro-iliac Disease.—This is so rare in childhood that it need hardly be considered, but in the early stages it may simulate hip-joint disease. The course is very slow. There is a distinct limp,

and pain which is much more severe than in hip disease. The joint becomes quite swollen, and the atrophy which takes place in the buttock is early. While at rest the child is easier, for the pain is less or disappears altogether, but motion at once results in its production. Abscesses are common. The movements of the hip are all free, but examination usually shows thickening over the joint which is affected. Care must be exercised not to mistake the early symptoms for disease of the lumbar region.

Tuberculous Dactylitis.—This not infrequently affects children during the second and third years of life, but may occur at any

Fig. 144.—Double congenital anterior dislocation of both hips.

Fig. 145.—Congenital dislocation of right hip (Napier).

time from the first to the fifteenth year. The metacarpus is most commonly affected. Usually the child so affected is a typical tuberculous subject and the affection simply occurs as a part of a general infection with tuberculous disease.

The enlargement of the bone is uniform, and it is not until several weeks that its maximum is reached. During this time there is no pain, but the movements of the bone are impaired. The skin is at first free from any involvement, but soon becomes thinned, and finally yields, so that a deep sinus is left with granulations. Syphilitic dactylitis is much less common than the tuberculous

form and occurs in a child who is of an entirely different type. The history of the two cases are very dissimilar also. The syphilitic form is at once amenable to proper treatment.

Enchondromata run a much more protracted course and without any tendency to suppuration. They are recognized by their hardness and immobility, and the first feature is usually sufficient to distinguish them from tuberculous dactylitis.

SYPHILITIC DISEASES OF THE BONES

The bone diseases which occur in the course of syphilis might be well divided into two groups: those which accompany the early manifestations and those which accompany the later ones.

Acute Epiphysitis.—This is the most common variety which accompanies the earliest manifestations of the disease. In nearly

Fig. 146.—A characteristic posture in acute epiphysitis of the hip; the limb of the affected side is drawn up to relieve tension.

every instance the onset is very acute, so that the first thing which is noted is that the infant is unable to move the limb. The danger is in mistaking this condition for one of sudden paralysis. While the limb is absolutely motionless, the slightest attempt at passive motion is accompanied by intense pain. These symptoms almost always occur during the first six weeks of the infant's life, and often before any other manifestations of syphilis are present.

It is not long before a swelling is noted at about the epiphyseal line; this swelling is very noticeable in a superficially situated bone, but not so much so in a deeper situated one. There is generally quite a marked limitation of the enlargement to the end of the bone,

but in those rare extreme cases it may involve much more of the limb.

With appropriate treatment the duration of the disease is short, but if improperly treated, or if it goes on to suppuration, the course is much protracted. If scurvy occurred before the seventh month of life, the difficulty of differentiation between it and epiphysitis would be great, for there are so many features which are so common to both, but scurvy is very rare before the seventh month (and in any event, never occurs as early in life as epiphysitis), and then, in addition, there is the clear history of some nutritional fault preceding the symptoms of the disease for a long time (usually the use of some proprietary food).

The bones which are most often affected are the humerus, radius, and ulna.

Chronic Osteoperiostitis.—The typical changes due to this disease are observed in the tibia. There is usually a forward curve of the anterior surface of the tibia, and the appearance of that bone is then saber-like; it looks as though the bone was compressed at the sides with an arch forward. This arch is only apparent, however, for there is no actual curve of the shaft of the bone, the appearance being due entirely to new-formed caseous tissue on the anterior surface. There is some liability of mistaking such a condition for rachitis, but in rachitis there is a distinct curve and not simply a unilateral thickening, and, further than this, the rachitic curvature occurs when the child begins to walk or stand.

The new bone deposit is the result of a specific periostitis, and therefore in the beginning it is accompanied by much pain. The pain is worse at night and is the earliest symptom, being present usually for a considerable time before the occurrence of other symptoms. When thickening occurs, the pain usually is much relieved or altogether disappears. There are always atypical cases, and in these the pain may be such as to be noticed only when the child is freely handled, and in these instances the diagnosis is made by the pain being worse at night, tenderness being always more or less present, and the other manifestations of syphilis being present.

If the cranium is affected, the usual form is that of a gummatous periostitis. These gummata are half-spherical, limited swellings, which are quite painful. In the commencement they are solid

but soon there is a distinct fluctuation felt, and about the same time they become more or less adherent to the skin.

It is rather unusual for any other disease than syphilis to cause localized disease of the cranial bones, so that if it is possible to eliminate injury as a cause, such disease is almost certainly syphilitic. The various bone lesions of syphilis are readily mistaken for the lesions which occur in some cases of scrofulosis, but in syphilis the whole history is different, and in scrofulosis it is the short bones and the epiphyses of the long ones that are most commonly affected. Pain during scrofulosis is usually very slight or absent altogether, and the bone itself is not enlarged, the swelling being largely edematous.

The result of treatment is of immense value.

Syphilitic Dactylitis.—This is not a frequent disease, but the symptoms somewhat closely resemble the tuberculous form, usually going on to suppuration and necrosis. The diagnosis must distinguish between the two forms of the disease; they occur in entirely different types of children, and the syphilitic form is very amenable to treatment, while the tuberculous is not. Tuberculous dactylitis occurs almost invariably as a part of a general infection in a typically tuberculous child.

THE LYMPHATIC GLANDS

In perfectly healthy children with an average amount of development of the tissues it is not possible to palpate the lymphatic glands.

Acute enlargement of the lymphatic glands is the usual accompaniment of some of the acute infectious diseases. In this particular it is not simply an accidental occurrence, but there exists a well-established connection between the location of the adenitis and the disease with which it is associated. Such an adenitis may prove of value in diagnosis, if its location and extent are considered.

Fig. 147.—Location of lymphatic glands. (For explanation, see page 479.)

Although no age is immune, acute enlargement shows a special preference for the developing period. Any lymph-node of the body may become the site of an enlargement, but the glands most often affected are the cervical, both anterior and posterior to the sternomastoid muscles, beneath the angle of the jaw and under the chin.

It is not common for a solitary gland to be affected, but the enlargement shows in a group of nodules which are freely movable and somewhat definitely outlined. Sometimes it happens that a group will enlarge at once, with periglandular infiltration, forming a tumor in which separate nodes cannot be made out. The skin covering this swelling may be shining and tense.

The course of an adenitis depends upon the nature of the infectious microbe and upon the resisting powers of the child. Staphylococcus and streptococcus infection may lead to suppuration and breaking down of the glands, but suppuration is not the rule. The usual course is gradual subsidence within a period of two weeks.

Aside from the diagnosis of an adenitis, there should be a recognition of its cause, and when the enlargement is in the cervical glands, this may be found to be some faucial, nasal, pharyngeal, or aural disease. Disease of these latter situations often explains the persistence of cervical enlargement after diphtheria and scarlet fever. Inguinal adenitis may accompany vulvovaginitis in girls, or preputial or urethral lesions in boys. On the other hand, it usually is associated with any suppurating lesion of the lower extremity.

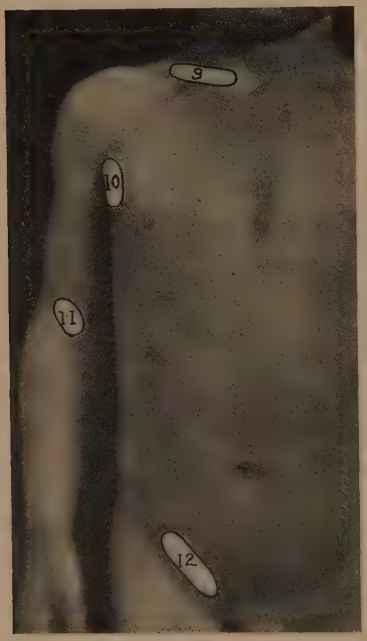

Fig. 148.—Location of lymphatic glands. (For explanation, see page 480.)

To avoid repetition, it may be stated, as a general fact, that adenitis is not an unusual accompaniment of infected lesions and abrasions, and that the location of the lesion determines the situation of the affection of the glands.

Chronic Enlargement.—This indicates some serious derangement of the general nutritive processes or some catarrhal lesion. In any event, the cause should be sought for, and this will usually be found either in scrofulosis, tuberculosis, leukemia, or in some general malnutrition.

Occasionally, during infancy, numerous small, hard, painless glands can be palpated in the neck, the groin, or the axilla, and such a condition is indicative of scrofulosis. If, in addition to this, the infant is anemic and weak, and the spleen is noticeably enlarged also, one may justly suspect tuberculosis.

Of course, in considering the presence of such glands, acute disease must be excluded and the chronicity established. There is a very marked proneness of chronically enlarged glands to exhibit acute exacerbations, and this is expected, as it is only one other evidence of the susceptibility of children with chronically enlarged glands to infection from trivial causes.

THE LOCATION OF LYMPHATIC GLANDS AND THEIR DRAINAGE AREAS.

(From Curnow and Treves.)

Suboccipital, Mastoid, } ..... Posterior half of the head.

Parotid ..... Anterior half of head, orbits, nose, upper jaw, upper part of the pharynx.

Submaxillary ..... Lower gums, lower part of face, front of tongue, and mouth.

Suprahyoid ..... Anterior part of tongue, chin, and lower lip.

Superficial cervical .. Exterior ear, side of head, and neck and face.

Retropharyngeal ..... Nasal fossæ and upper part of pharynx.

Deep cervical ..... Mouth, tonsils, palate, lower part of pharynx, larynx, posterior part of tongue, nasal fossæ, parotid and submaxillary glands, interior of skull, and deep parts of the head and neck, upper set of lymph-glands, lower part of neck, and joining axillary and mediastinal glands.

Supracondyloid ..... Three inner fingers.

Axillary ..... Upper extremity, dorsal and scapular regions, front and sides of trunk and chest.

Anterior tibial, Popliteal, } .... Deep lymphatics of the leg, and receive some vessels from the skin of the leg and foot (chiefly outer side).

Inguinal ..... Femoral set: Superficial vessels of the lower limb, and partly of buttock and genitals, perineum. Horizontal set: Abdomen below the umbilicus, buttock, and genitals. The deep vessels of the lower limb go to the deep glands along the femoral vein.

Iliac ..... The pelvic viscera and the deep vessels of the genitals partly.

Lumbar ..... All the lower glands, uterus, testes, ovaries, kidneys.

Sacral ..... The rectum.

THE SITUATION OF THE PRINCIPAL LYMPHATIC GLANDS AND THE CONDITIONS WHICH ARE SUGGESTED WHEN THEY BECOME ENLARGED OR TENDER ACUTELY.

1. Diseases of the ear (especially eruptions); eruptions about the face; and occasionally during parotiditis.
2. Mastoiditis and infections and eruptions affecting the scalp.
3. Infections of the chin, the tongue, and the lower lip.

4. Infections of the mouth and teeth, stomatitis, rubeola, and rubella.
5. Infections of the tonsils, in the mild attacks of scarlet fever and at first in variola. In severe scarlet fever 5, 6, 7, and 8 may be much affected.
6. Pharyngeal infections and inflammations, therefore in retropharyngeal lymphadenitis. Also in severe scarlet fever and in rubeola.
7. Infections of the scalp and severe scarlet fever.
8. Infections of the scalp and severe scarlet fever.

(During the course of diphtheria, 4, 5, 6, 7, and 8 may become prominently enlarged, so that the whole neck appears badly swollen and tender.)

9. Infections of the neck and occasionally during the course of diphtheria.
10. Infections affecting the arm, the axilla, and the upper portions of the chest, anteriorly and posteriorly.
11. Infections of the hand, and especially of the three inner fingers. Quite frequently this is enlarged during the course of a syphilitic eruption.
12. Infections affecting the lower limb, and particularly the thigh, and sometimes during the course of syphilis. In rare instances these glands are affected in rubella.

THE ACUTE INFECTIOUS EXANTHEMATA

The diagnosis of the cutaneous eruptions which accompany and are an integral part of the acute infectious diseases cannot properly be taught by description, no matter how well chosen the words or how skilfully executed the plate to illustrate them. It is only by a wide experience that one is able quickly and correctly to distinguish them when the course is not typical. If certain well-established facts are borne in mind, the diagnosis is much simplified, and the failure to take the time and pains which are necessary to elucidate these will lead one into various errors in the diagnosis. These established facts are as follows:

(*a*) All diseases of this class are contagious (rubeola, rubella, scarlet fever, variola, varicella). The time taken clearly to bring out the history of exposure to one of these diseases is never wasted. The very prevalence of the particular disease in question is often the first thing that leads one to suspect the real cause of the first indefinite symptoms and aids in an early diagnosis. This becomes particularly forcible when one or more members of a particular family have been previously and recently affected. To be able to take a clear history implies that there is an intimate knowledge of the various periods of incubation, for without that, even with a history of exposure, one would not know when to look for the first symptoms.

(*b*) There is a distinct incubation period. This period is referred to as an incubation period because, after a known exposure, there is a varying time in which there is an absence of all symptoms, and while in some of the diseases this time is very definite, in others it is less so. The various incubation periods are as follows:

Rubeola: From the time of exposure until the first catarrhal symptoms appear there is usually an interval of eleven days; then follows the stage of invasion, which lasts for about three days, at which time the eruption may be detected in the mouth a short time before its appearance upon the cutaneous surface.

Rubella: From fourteen to eighteen days.

Scarlet fever: From twenty-four hours to five days. The shorter period is the usual one.

Variola: The average is twelve days.

Varicella: Fourteen days.

All these periods may be subject to slight variation.

(*c*) A certain immunity is acquired by previous infection. In all the acute infectious exanthemata a certain immunity is acquired when the patient has been once attacked by the disease. Whatever the explanation of this immunity may be, it clearly involves some systemic change which usually persists throughout life.

Popularly, this is not so, and case after case is recited by the layman to show the possibility of second, third, and more infections with the same disease. This is brought about largely by hasty diagnosis, so that in the presence of a history of previous infection a very full history of that illness must be obtained. In the case of scarlet fever the questions should be such as to determine the length and severity of the illness and whether any sequels developed, for erythemas are often diagnosed as scarlet fever, and so mislead as to second invasions.

An attack of urticaria is frequently called rubeola, as is also rubella. Rashes caused by the ingestion of certain articles of diet and of medicines occasionally lead to hasty and incorrect diagnosis, with subsequent uncertainty as to the occurrence of disease.

(*d*) All have a more or less typical course. This might be divided into stages: the incubation, which has been referred to; the prodromal, which commences with elevation of temperature; the eruptive; the declining; and convalescence.

A cutaneous eruption, dependent upon any specific infectious cause, is influenced by the general condition of the skin of the person affected, as well as by its structure. To distinguish these differences there must be a consideration of the age of the child (the younger the child, the more tender the structure of the skin, as a rule), the general state of nutrition (a poorly nourished infant means a poorly nourished skin), the cleanliness of the skin, idiosyncrasies toward the development of erythemas and urticaria.

In one child we will find a very tender skin with scarcely visible glands, but with a capillary circulation which is so superficial that it imparts an unusual glow to the parts, while in another child the reverse may be true. The skins of both children should not be expected to react exactly alike under the influence of cutaneous eruption.

Every eruption should be very minutely examined, and preferably in good sunlight (a small vest-pocket magnifying glass being a valuable aid, and at times a necessity), and the more recent efflorescences must be observed in order to determine the original form of the eruption. When these are seen, then it is a simple matter to compare the further development of the rash.

The diagnosis should never depend upon the character of the eruption alone, but the time, manner, and distribution of the rash and the associated symptoms must all be considered. This is particularly true if the disease seems to differ from the usual type. It is quite necessary that the diagnosis be made as early as possible, so that protection may be afforded to those who may be brought in contact with the case; therefore it is very important that the symptoms of the prodromal period be prominently kept in mind.

In rubeola there is usually a distinct prodromal stage of three days with well-marked catarrhal symptoms, primarily of the upper respiratory tract. In scarlet fever the prodromes last for one or two days, with an unusual increase in the rate of the pulse, vomiting, and faucial involvement as the prominent symptoms. In rubella there is usually a complete absence of prodromes.

In addition to this, whenever there is a suspicion that a disease is contagious, efforts should be made to isolate the patient until the diagnosis is fully established.

RUBEOLA

The preëminent symptoms of rubeola are fever, catarrh of the upper respiratory passages and of the eyes and an eruption. The disease rarely occurs more than once during a lifetime, so that one attack affords a certain amount of immunity from another. There seems to be a partial immunity which exists for the first five months of life, so that the disease is an unusual

occurrence before that time. The apparent immunity of adults is brought about by the occurrence of an attack during earlier life.

The incubation period is generally free from any deviations from normal conditions, but there may be slight temperature changes. If these are present, they consist of a morning elevation of one degree and an evening rise of less than two degrees Fahrenheit, as a rule. When such an elevation of the temperature occurs, there is always an associated slight catarrhal condition of the conjunctiva, which persists only for a brief period and disappears before the development of the usual prodromes of the affection. If the temperature rise exists alone, then it is due to some other condition besides the infection.

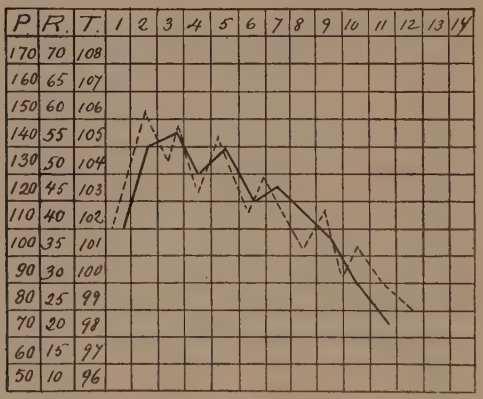

Fig. 149.—Temperature (——) and pulse (----) in rubeola. Child three years old.

The diagnosis of measles is unfortunately uncertain before the appearance of the characteristic eruption upon the skin, with the one exception that if we are able to demonstrate the Koplik spots, the diagnosis is at once made positively. During the time that measles is epidemic, or when there has been a known exposure to the contagion, the onset of a catarrh with involvement of the eyes should at once excite suspicion. During the catarrhal stage of the disease there are coryza, slight nasal discharge, usually more or less sneezing, disturbed sleep from the occlusion caused by the swollen mucous membranes, and occasionally, in infants, epistaxis. To these are added, as a rule, a sense of pain or pressure in the eyes (a symptom which is very unusual in all other coryzas), and this results in rubbing of the eyes on account of the irritation. Lacrimation is more or less in evidence, and photophobia may be severe, so that the child buries its face in

the pillow in the effort to avoid light. The conjunctiva is injected. During this stage cough is somewhat characteristic and is dry, harsh, and paroxysmal. Even when the cough is of mild degree, the voice is muffled or hoarse from the first onset of the catarrhal stage.

It is just at this time that the search for the presence of Koplik's spots is of most value in the diagnosis. The mucous membrane of the cheek should be carefully examined, for it is only with much diligence that the fine eruption can be detected at this time. The best illumination is sunlight coming directly from the side, or diffused daylight. It is very difficult to see the spots by gaslight.

The spots are found upon the inner surfaces of the cheeks, behind the angle of the mouth, and have the appearance of little specks of lime sprinkled upon the mucous membrane and upon a reddened base. They are raised above the surface, are of a bluish-white or yellowish-white color, and cannot be wiped off. Such spots do not appear as prodromes in any other cutaneous rash which resembles measles, so that they are valuable aids to the diagnosis.

During this catarrhal stage influenza may be suspected as the cause of the catarrh, the cough, and the general distress, but the doubt cannot exist long, as a rule, for by the second or third day the prodromal eruption is observed in the mouth. It sometimes happens, however, that this prodromal rash does not develop frankly, and then the differential diagnosis is more obscure. In favor of influenza we find that the primary rise of the temperature is less, the photophobia is not so marked, and there is no appreciable fall of the temperature on the second day.

It must be remembered that all the typical symptoms of the catarrhal stage may not be present, but that only one or more may be in any prominence, so that a disturbance of the general good condition of the child is evidenced, but without apparent cause.

While the catarrhal symptoms persist for a week or a little more (that is, until the eruption is fully developed), and begin to subside coincident with the fading away of the rash, the symptoms of the invasion really last for only three days, for at the end

of that time the eruption appears in the mouth. On the mucous membrane of the palate there appear individual deep-red serrated spots, inside of which the solitary and swollen follicles are observed as individual nodules. Such precede the cutaneous eruption by a brief period. At the end of the third or the beginning of the fourth day the first macules appear upon the skin of the face (about the nose, the lips, and the chin), from which point there is an extension to the rest of the face, the neck, the upper trunk and arms, the lower trunk, buttocks, thighs, forearms, legs, and feet, and usually in the order named. This whole process of extension (from face to feet) occupies about thirty-six to forty-eight hours.

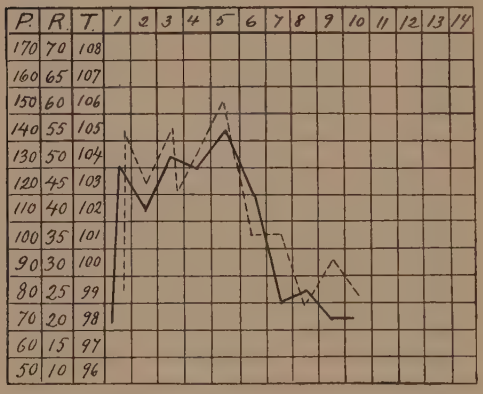

Fig. 150.—Temperature (——) and pulse (----) in rubeola. Child six years old.

The first appearance of the spots is peculiar; they are small (pinhead size), round, not raised above the level of the skin, and are of a light red color. They rapidly become larger, much more irregular in shape, of a deeper red, and with a tendency to coalesce. When they attain their typical development, they are irregular, serrated, crescent-shaped macules inside of individual ones, and in the center of each spot one may detect by sight or by touch a small nodule of a redness similar to that of the spot itself. In the larger macules there may be as many as four such nodules.

These nodules correspond quite closely to the sebaceous follicles and the hair-follicles, and as the glands secrete more abundantly than normal, the eruption has a slightly greasy feel. In its full development the macule is raised above the level of the skin.

At the acme of the eruption the entire skin from head to feet

is covered with the closely crowded individual points of the rash, and for a short time the eruption remains at its height. The hairy portions of the body are covered with eruptions as well as other parts, but the soles of the feet and the backs of the hands are generally most affected.

The usual appearance is sometimes altered (and this is particularly so upon the back) when the macules coalesce completely, forming large groups, and this gives the skin the appearance of being covered with a connected eruption, which appearance is quite distinct from the spotted skin of the ordinary rash.

It is not infrequent that the eruption becomes slightly hemorrhagic, and in that case the color is much darker; and if considerable areas are involved, it becomes a dark bluish-red, which finally fades into a greenish or yellowish hue. Its main importance is in the fact that it might hastily be mistaken for a general cyanosis, which, when it occurs during the course of rubeola, is of evil import.

With the full development of the eruption the disease reaches its height, and at this time the temperature is almost continuously high (103° to 105° F.) and the nervous system more or less affected. Anorexia is so marked that it is usually complete; there is great irritability, sometimes delirium, and the catarrhal processes are all exaggerated. The dry, harsh cough is very troublesome, the eyes are very sore, there is marked photophobia, and the secretion from the nostrils is so irritating that it excoriates the upper lip. The physical examination will almost invariably reveal the presence of bronchitis of the larger tubes. The lymph-glands of the neck, of the axilla, and of the groin may become considerably enlarged at this time, and at times are more or less painful.

It is fairly characteristic of the disease that its severity is progressive with the development of the eruption, and when that is at its height, the disease is at its acme. The change for the better comes quite suddenly. At the time that the child is suffering most from fever, the catarrh, the cough, and general discomfort, there comes a sudden relief, so that within a few hours the little one appears to be almost entirely well. He is inclined to play, the appetite returns, the mind is clear, the fever almost if not entirely gone, the sleep is undisturbed, the cough becomes loose,

and the whole picture is of rather sudden and marked improvement.

Here it is that there is danger of considering the disease at an end, for the child appears to all to be so well; but that the disease in a way still persists is shown by the slow clearing up of the catarrhal symptoms and the fact that it is during this period that the sequels are apt to develop. The conjunctiva still is moist with the secretion, the cough slowly disappears, and the voice remains hoarse or more or less thickened for several days. The skin remains for some time sensitive to the influence of cold,

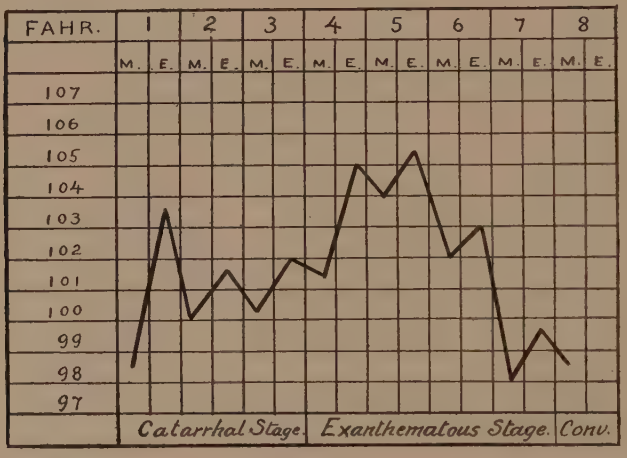

Fig. 151.—Temperature chart of rubeola of moderate severity in a child of four and one-half years.

and sweating may be quite marked. The pulse is abnormally slow and exhibits some irregularity. There is no positive indication by which we may feel assured that there is a complete return to health, and the desquamation which takes place is also uncertain in its duration. Several days at least must intervene before we can consider the child well.

The fever in measles is not of a constant type, and in individual cases the character of the temperature curve may vary. However, in most of the cases the fever is remittent in the first days, is at its highest elevation during the full development of the eruption, and exhibits a rapid fall after the complete development of the

rash. There are, therefore, usually two maximums and a sudden termination with a short fastigium. The first maximum is observed upon the first day of the prodromal period; the second, upon the first or second day of the eruption. If the initial maximum is low, then one may predict with safety that the attack will be light. Fig. 151 shows a temperature chart of a case of measles of moderate severity.

The diagnosis is not difficult when the case is quite well developed or if it follows a somewhat typical course. The possibilities of error in diagnosis in the first stages, when the fever and catarrhal symptoms are the prominent ones, have already been referred to.

In the early eruptive stage rubeola may readily be mistaken for variola, but this error is not so apt to occur in childhood as it is in later life. In children the prodromal eruption in the mouth and the catarrhal symptoms of rubeola are usually both well developed, and both of these are absent in variola, so that even in those exceptional cases (which so often lead to error in adult life) where the macule of rubeola is infiltrated, intensely red, and glistening, the diagnosis is usually easy. With such a modification of the eruption and the catarrhal symptoms quite mild, the difficulty would be much greater, so that the history of a recent and successful vaccination would be of value. Even so, the decision may have to be postponed for another twenty-four hours, when one is able to make further distinctions; the variolous eruption is much slower in its development and is less abundant at first than the rubeolous spots, so that very numerous papules on the face, being quickly developed, would be in favor of a diagnosis of rubeola.

When variola is developed sufficiently to have a wide-spread distribution, one is always able to find some vesicles, although they may be small, while the color of the papule is pinkish, in contradistinction to the more reddened spot of rubeola. Occasionally rubeola maintains its primary macular character, and the eruption may then resemble scarlet fever to a considerable extent. Unfortunately for the diagnostician, in most such cases the catarrhal symptoms are not prominent except in the pharynx, so that a further difficulty is added in the differentiation.

However, we recall that the eruption in rubeola is as decided about the nose, lips, and chin as it is elsewhere upon the face, and, further than that, this is usually the first part invaded. In scarlet fever these parts are usually spared, so that the contrast between the clear portion and the parts covered with the eruption is itself an aid in the diagnosis. If pressure be applied over the reddened area, the small reddened points reappear when pressure is removed. The measles eruption, even when confluent, is of a uniform red color without any points of a more intense hue.

Rubella may occur with the eruption at first being "measly," and under those conditions may be mistaken for rubeola. The rash of rubella has the character of the rubeola eruption, but is more pallid, and the eruption is much quicker in its development, spreading all over the body within twenty-four hours. The same distribution occupies two or three days in measles. For several days preceding the eruption of rubella there is usually some tenderness and enlargement of the posterior cervical glands (in rubeola, if this occurs at all, it is late in the disease), the catarrhal phenomena are slight or absent, the fever insignificant, and there is no photophobia. Upon the positive side of rubella we observe the glandular enlargement and sore throat, the first being quite uncommon and the second rare in rubeola.

There are many drugs which, when administered to children, will cause the appearance of a diffuse eruption. Antipyrin is the one which is most apt to cause an eruption in children which resembles measles. When the history of its administration is obtained, the diagnosis is easy, for there is an entire absence of the usual associated symptoms of measles.

In some few cases of epidemic cerebrospinal meningitis the eruption is profuse enough to exhibit a certain amount of similarity to rubeola, but usually the spots are localized upon the extremities and sparsely upon the trunk. The phenomena which are associated with inflammation of the meninges are usually sufficient to at once make the distinction plain.

The eruptions which at times develop during septic affections, and which may markedly resemble the eruption of rubeola, are differentiated by a study of the associated symptoms, which makes the diagnosis self-evident.

Deviations from the Usual Course of the Disease.—It is quite necessary that the principal deviations from the usual course of rubeola be remembered, for otherwise the diagnosis would be made more difficult and at times impossible.

During the period of incubation there may be slight elevations of the temperature (one degree in the morning and less than two in the evening) with an associated very slight catarrh which involves the eyes and nasal passages. The result of this is that the history is obtained of slight catarrh with cough and some malaise existing for several days. The chance of error comes in

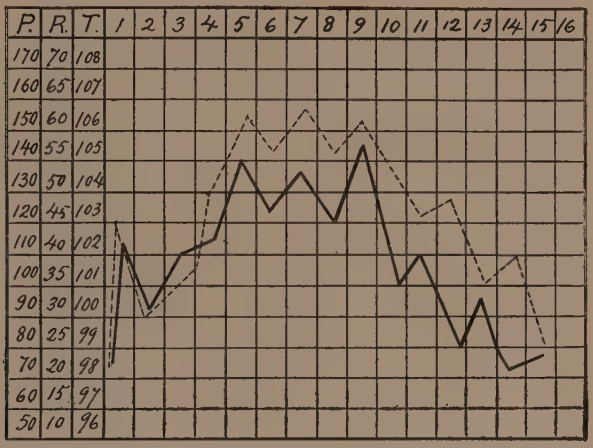

Fig. 152.—Temperature (——) and respiration (- - - -) in rubeola with bronchopneumonia. Child two years old.

considering the real onset of the severe catarrhal symptoms as an acute exacerbation of a previously existing catarrhal cold.

During the stage of invasion the symptoms may be very slight, and the history obtained is that the child was perfectly well up to the time of the appearance of the eruption. The danger of error is in considering such cases as rubella, for, as a rule, with mild catarrhal symptoms the whole course of rubeola is mild.

The stage of invasion may come on with most severe symptoms (continued high temperature, convulsions, intense catarrhal symptoms, vomiting, coma) and may last for several days. The possibilities of error are great and the mistakes varied. The appearance of the rash decides the case.

The stage of invasion may be abnormally prolonged (five, six, or seven days), with a remittent type of fever throughout. But with this course there is always the development (partial) of some of the spots somewhere upon the body, just at the time that the eruption should be well developed. Of course, if a thorough examination has been neglected, these will not be noted.

The catarrhal symptoms may be intensely developed, so that the child exhibits a dyspnea, and the mucopurulent secretion in the nose is so profuse that the child suffers great discomfort. This may be accompanied by profuse epistaxis. In a short time the eustachian tube and the larynx may become affected. I have seen such cases diagnosed as diphtheria, and that seems to be the chief danger. When the frequency with which measles is associated with diphtheria is remembered, it is little to be wondered at that the diagnosis sometimes is made of both diseases existing together. The catarrhal symptoms may be slight and associated with a simple or a purulent inflammation of the glands at the angle of the jaw.

The eruptive stage may also exhibit deviations.

The course may be very mild and the eruption slight, or, in other instances, remaining but a few hours or only one day. In rare instances there may be no eruption at all.

Sometimes the senses are markedly affected from the very start, even though the disease runs a moderate course in all other particulars. During the period of invasion the child is apathetic and somnolent. On the fourth or fifth day a few macules may appear, but they are pale and indistinct and confined largely to the trunk. The child may have a hunted look, and somnolence usually alternates with mental irritability. After a few days general convulsions supervene, and may last for hours, terminating life. In such cases the eruption may follow one of two courses: remain undeveloped permanently, or remain so for a few days and then develop rapidly as death approaches.

"The measles have struck in"—that is the greeting which one sometimes hears, and this is the way in which it appeals to the lay mind. Such a happening usually occurs during the first year of life, and the very first indication of anything unusual is during the stage of invasion: the child suffers from more or less

dyspnea. Other than this there is nothing unusual, and the eruption develops in the regular order up to a certain point, when its development is suddenly arrested and a cyanotic hue is noticed instead of the usual red. The child then fails rapidly, and the whole picture is one of an extreme lung and bronchi involvement. The heart grows weaker rapidly, diarrhea usually is profuse, and while the signs of bronchopneumonia are gradually becoming more and more evident, the fatal issue is reached (usually with convulsions) about the eighth day.

Some few cases have been reported of a relapsing eruption,

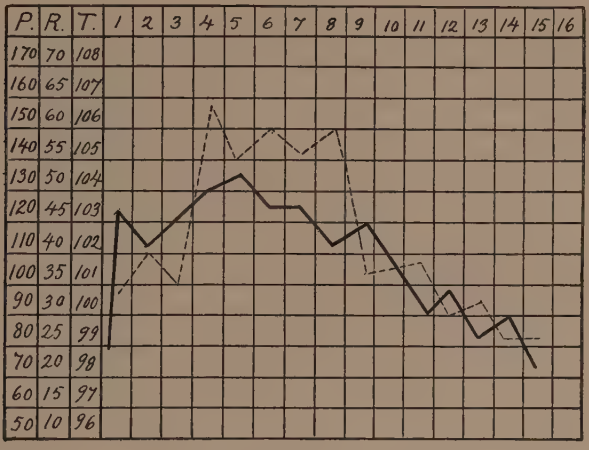

Fig. 153.—Temperature (——) and respiration (- - - -) in rubeola with bronchopneumonia. Child three years old.

but such are exceedingly rare, if we judge by the literature on the subject.

Deviations during convalescence are many and important.

The defervescence may be incomplete or there may be a subsequent rise of temperature which is considerable, both of which may indicate simply an irregularity in the course of the disease or the occurrence of a complication. The catarrh of the eyes may persist and finally eventuate in an ophthalmia which may prove destructive to sight. Persisting in the nose, the catarrh may lead to ulceration of the mucous membrane. The eustachian tube may become involved from an extension of the infectious process in the pharynx, and otitis media result. At the time

of defervescence a more or less profuse diarrhea may occur, and this is particularly true of nurslings, and convalescence is thereby much prolonged.

The complications may be varied. The sequels are many, and it is needful to mention the more important of these, as their recognition may be influenced by their occurrence during the attack of rubeola. The most common are ophthalmia, aphthous stomatitis, chronic otorrhea, noma, inflammations of the bronchi and the lungs, rheumatic and cardiac affections, catarrhal laryngitis, and tuberculosis.

RUBELLA

In a very large measure it is the eruption upon the skin which is of most value in a differential diagnosis of the various acute infectious exanthemata, and this is particularly true of rubella, on account of the few associated symptoms of the affection.

There is no typical uniformity about the rash of rubella. At times it consists of large, slightly elevated papulo-macules of a rose-red color. In such instances the greatest similarity is to the eruption of rubeola, but the latter is of a much darker hue. In still other cases the eruption is small, so that at a hasty examination the resemblance to scarlet fever may be marked, but in rubella the finely punctiform eruption which is observed in scarlet fever is never seen.

The individual macule usually has an irregular serrated limitation, and the macules so distributed that in some parts of the body there is a considerable stretch of normal skin in between. There is but a slight tendency to grouping. The distribution of the eruption is, as a rule, from the head and face downward, but at times it is first observed upon the chest and arms. Below the knee the macules are but scarce.

Regardless of the eruption itself, there are two clinical features of the affection which are of more or less import: the enlargement of the superficial cervical glands and splenic enlargement.

The lymphatic enlargement is not severe, but moderate or slight, and is present usually for several days preceding the eruption. It is frequently the very first indication which we have of the onset of the affection. It has a distinct diagnostic value, and particu-

larly a differential one, for in measles lymphatic enlargement may occur late in the disease and is dependent upon the severity of the catarrh, while in rubella it is of primary occurrence.

The splenic enlargement is but moderate, but is present from the onset to the end of convalescence.

Rubella may run its entire course without any elevation of temperature, but usually there is a slight rise (101° to 102° F.), which is highest at the onset of the affection and disappears by a rapid lysis. In rare instances the temperature is markedly elevated, with the usual associated symptoms of such a disturbance.

The average duration of the eruption is three days, but occasionally it lasts for four, and not infrequently a shorter period (one or two days) is noted. The fading of the rash is usually in the order of its appearance and is generally rapid.

When the rash of rubella simulates that of rubeola, the differential diagnosis is suggested by the paler tint of the rubella eruption, by its more rapid appearance (developing within twenty-four to thirty-six hours, whereas in measles two or three days are required for a general distribution), and in the absence or mildness of associated symptoms of elevated temperature and catarrhal inflammation of the upper respiratory organs. The history of exposure is of immense value, for it is the sporadic cases or those which occur early in an epidemic that offer the greatest difficulties in diagnosis.

As has been stated, the eruption sometimes resembles that of mild scarlet fever, but the eruption in rubella shows a special preference for early development about the nose, chin, and lips, the points which are almost invariably spared by the scarlet fever rash. In the beginning of scarlet fever vomiting is common, as is also painful deglutition, both of which are very unusual in rubella. In rubella the eruption is usually the first symptom, with one exception—the lymphatic enlargement. Both in rubeola and in scarlet fever before the appearance of the eruption there are more or less clearly defined symptoms, which are suggestive.

If antitoxin has been used for the control of diphtheria or for immunization, it may result in a rash which consists of flat macules and papules, and when rubella is epidemic, this rash may create some confusion. However, we have the history of the use of the serum to arouse our suspicions, and unless a refined serum has been

used, the chance of subsequent eruption is large. The macules are usually larger than those of rubella and irregularly distributed.

Generally speaking, it is rarely safe to consider a case as rubella unless the disease is epidemic or typical. Even then the chances of mistaking mild cases of scarlet fever and of rubeola for rubella are great, and there is no question but that many times the error is made. The cases which simulate scarlet fever are the most trying ones. It is the part of wisdom in such instances to consider the case as one of scarlet fever until the case is so advanced that a positive diagnosis is possible.

SCARLET FEVER

Every child who is taken suddenly ill with vomiting, sore throat, and high temperature should at once be isolated as a scarlet fever suspect until the contrary may be proved to be the case.

Of all the modes of onset, that which is accompanied with vomiting is most common, and in a case of moderate severity the act is repeated several times during the early hours of the disease. In children under three the vomiting is generally associated with more or less profuse diarrhea which lasts for a day or two. According to the time of the last meal, the vomiting consists of food, mucus, or bile-stained fluid.

In children over the age of five (and particularly in those over ten) an initial chill may be present. There may also be a complaint made of several hours of general malaise, cephalalgia, irritability, and muscular pain, preceding the onset.

From six to twenty-four hours after the first symptoms of illness the child may complain of pain in deglutition, but this is only so as the child becomes older, young children making no such complaint. When the examination of the oral cavity is attempted, it is found that the tongue is white-coated and the filiform papillæ are reddened; the palatine mucous membrane is very noticeably congested, showing small but distinct macules; the tonsils are enlarged and deeply reddened, and there may be, even at this time, the presence of reddish, yellowish striæ upon their surface.

The temperature is always elevated, and usually to a considerable degree (103° to 105° F.), and this febrile condition persists for

from eight to ten days. Even during the first twenty-four hours of the fever the child is irritable, complains of thirst, is apathetic and sleepy, or at night may be delirious. The voice is usually changed, so that it appears muffled, and the child, if old enough, may complain of pain or burning in the throat.

During the course of the first day or the first half of the second day of the disease the characteristic eruption generally appears, beginning first upon the neck and upper portions of the trunk and sometimes in the gluteal region, and then spreading rapidly (within one or two days) until the face, the whole of the trunk, and the extremities are involved.

A peculiarity of the eruption upon the face is that it seems to spare the region about the lips and nose, and sometimes of the chin, and this results in a marked contrast between these parts and the rest of the face. Such a contrast may be of considerable value in differential diagnosis, for in measles and rubella the parts about the nose, chin, and lips, are usually the first affected by the eruption.

The eruption of scarlet fever has these peculiarities: (*a*) At the very beginning it consists of small points which are definitely separated from each other, although they are thickly crowded; (*b*) in the course of a very few hours these coalesce, forming a uniform red eruption; (*c*) the spots or points are not located upon normal skin, but upon a surface which is at first a delicate red or pale pink, but which later assumes a scarlet appearance, from which the disease derives its name.

It usually requires more or less close observation to distinguish the distinct red points, for at a short distance the appearance seems to be one of uniform redness. The increasing redness is progressive, and while at first the skin feels smooth, as the redness becomes more and more pronounced the skin assumes an uneven and coarse feeling. Usually in the inguinal region, upon the buttocks, the inner surface of the thighs, at the elbow-joint and knee-joint, and the axilla, the eruption is more intense than elsewhere, and may be so pronounced as to give a bluish-red color to those parts.

In some instances there may appear vesicles which are very small and filled with a transparent fluid (which later on becomes more or less opaque), and these dry within a few days and form

scales. The favorite situation of such an eruption is upon the abdomen and chest, but it may affect the back, the hands, or the feet. It is characterized by the name scarlatina miliaris.

When the scarlet fever eruption is fully developed, the drawing of a sharp object (as the finger-nail) over the skin will result in the persistence of a white streak for some considerable time afterward. The eruption remains at its height of development for about twelve hours or a little longer, and then fades, so that it disappears by the end of the first week or the beginning of the second week. Desquamation is evidenced even before the fading of the eruption is complete, and may continue for several weeks, occurring in some

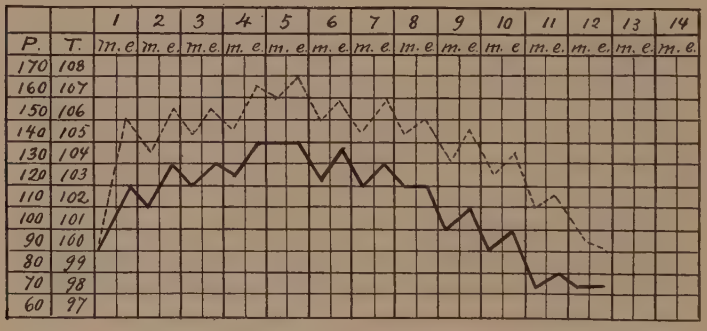

Fig. 154.—Pulse (- - - -) and temperature (——) of a simple uncomplicated scarlet fever. The acme in this case was reached somewhat late; the defervescence is rather marked.

situations as small flakes, and in others the skin is thrown off in large casts.

The temperature keeps close pace with the eruption, so that upon the third day the acme is usually reached, and then with the decline of the rash there occurs a gradual decline in the temperature. While there is a variation between the morning and evening temperature in the decline of the fever, if a previous morning or evening temperature is at any time exceeded, the cause should be sought for; an uncomplicated defervescence never shows such a rise.

The pulse is out of all proportion to the height of the temperature, being very rapid. This is irrespective of whether the case is severe or mild, and it is not unusual to find in a child of five with a temperature of 103° F. per rectum a pulse-rate of 160 to 190 per

minute. It is a peculiar fact that even with much higher temperatures the pulse-rate does not proportionately increase, although it still remains proportionately high.

With the progression of the eruption to its full development the other symptoms, like the temperature, usually keep pace, so that we observe an increase in the soreness in the throat, an intensification of the redness and swelling, but the tongue loses its white coating and is denuded of its superficial layer, so that it appears red and smooth, with the papillæ very prominent above the surface (the so-called strawberry tongue). The improvement comes with the subsidence of the eruption and is progressive with it.

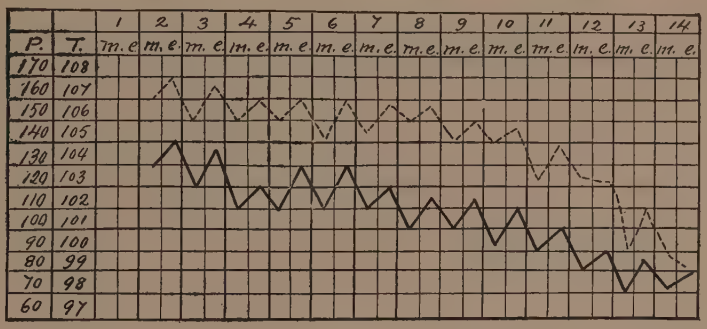

Fig. 155.—Pulse (----) and temperature (——) of an uncomplicated scarlet fever. The acme in this case was reached early (on the second day) and the defervescence was somewhat slow and gradual.

The glands at the angle of the lower jaw enlarge and become sometimes quite painful, and this enlargement may persist for a short time after the disappearance of the eruption. Toward the middle of the second week the symptoms have probably all disappeared with the exception of the desquamation, and convalescence is rapid.

Deviations from the Usual Course of Scarlet Fever.—The disease may be very mild, and in such cases the symptoms are but slightly developed, so that while vomiting is usually present even in mild cases, the angina and fever are not marked. The fever may be very transient or in some instances entirely absent. The eruption may exist in areas and remain pale in color, and may show a tendency to disappear quickly or remain several days in the original condition.

Now, there may be further anomalies in the course, in that one or more of the symptoms may be severe and the others all mild. This is sometimes observed in older children who have all the symptoms well marked (the throat especially), but with no eruption.

The symptoms in still other cases may be very pronounced, and the malignancy of the disease evidenced by the high temperature, the rapid failure of the heart, and the marked involvement of the nervous system. Death may ensue in such cases within a few hours, but usually the termination is delayed until the third or fourth day. The temperature may reach 106° to 108° F. within a few hours after the initial vomiting, and consciousness is lost early or at least is much blunted. The rash usually is slow of development. At times the onset is about the same as in a moderate case, and then, after the first twenty-four hours have passed, the disease takes on the severe form. In still other cases, while all symptoms are severe, the throat involvement supersedes all in severity.

Sometimes there is a deviation on the part of the eruption, and some of these have already been referred to. It may at times happen that upon the third or the fourth day nodules and papules of a deeply colored hue are observed distributed through a slightly uneven but not markedly raised eruption. Such is seen in the severe cases at times.

Complications which Markedly Modify the Affection.—*Scarlatinal Synovitis.*—This usually occurs after the fourth day, or not later than the tenth, and the large as well as the small joints may become affected, although the wrist, the knee, and the ankle are most commonly affected. The local signs are very much the same as those of an acute attack of rheumatism, or there may be no swelling or redness of the joints, but intense pain upon motion. Such a complication is of short duration, persisting only for from three to five days.

Scarlatinal Nephritis.—Practically all the severe cases of scarlet fever are accompanied by more or less albuminuria, and in most instances this is a so-called ordinary febrile albuminuria. But in a proportion of the cases (about 15 per cent.) nephritis occurs as a complication. If the case is septic or the angina severe, then the usual form of kidney involvement is acute degenerative nephri-

tis (see page 298), and occurs at the acme of the fever. But the lesion which is most characteristic is that which occurs usually during the third week of the disease, and is commonly spoken of as post-scarlatinal nephritis (see "Acute Diffuse Nephritis" on page 298).

Otitis.—This is such a frequent complication that its occurrence in a doubtful case has some diagnostic significance. It is especially apt to occur in infants, and more often during cold weather. While both ears are usually affected, they are involved at different times, and the usual time for the first symptoms is during the beginning of the second week of the disease. Persistent unrest and fever, marked anorexia, and diarrheal disturbances should at once arouse suspicion of this complication. Even with a perforation and good flow of pus, and with no detectable swelling over the mastoid, the fever may keep up, and indicates infection of the mastoid cells.

The foregoing are not the only deviations and complications; the disease may be complicated by one of the other infectious diseases (particularly diphtheria), by erysipelas, typhoid fever, or, in fact, most any disease of childhood.

The diagnosis of scarlet fever would oftener be made if one were on the lookout for it, and especially if every child who was taken suddenly ill with high temperature, vomiting, and sore throat was looked upon as a suspect. Of course, the disease cannot be positively diagnosed until the occurrence of the characteristic eruption, but suspicion may be aroused by certain symptoms and the case isolated early. The inconvenience of a needless isolation does not outweigh the advantage of isolation, if the case turns out to be scarlet fever. At the onset tonsillitis may readily be mistaken for the severer disease, but in the former the pulse-rate is proportionate with the rise of temperature and the congestion in the throat is not so sharply defined. In such cases the history of exposure to scarlet fever is of immense value, and the history of previous attacks of tonsillitis may prove of service in distinguishing these cases.

There are some cases in which the virulence of the disease seems to be spent upon the throat, and early in the attack the throat symptoms are severe, so that it may be difficult to distinguish such cases from diphtheria. As the eruption is usually delayed in its appearance and not generally characteristic in such cases, much

dependence for an early diagnosis must be placed upon the history of an epidemic and of exposure to the same.

This, of course, would be further substantiated by a bacteriologic examination. As to the symptoms present, a sudden onset with vomiting, high temperature, and very active inflammation in the pharynx would indicate scarlet fever. The disproportion between pulse and temperature would also have a similar indication.

By far the greater number of mistakes come from a misinterpretation of the eruption. In the well-developed cases the character of the eruption is sufficient, when associated with other symptoms of the disease, to make the diagnosis plain. But, unfortunately, there are other acute diseases which exhibit quite early in their course an eruption which may simulate some one of the forms of the scarlet fever eruption. Such may be the case in an acute lobar pneumonia, and it may be necessary to wait until the development of the physical signs of the pneumonia before the differentiation is positive. The most likely error, however, is in diagnosing the case as one of lobar pneumonia with erythema, when it is really a scarlet fever, and such errors usually are made because little or no attention is paid to the examination of the throat and to the history of exposure.

Then, again, there are many eruptions of the skin (toxic exanthemata) which are a source of much confusion, even to the experienced. It is, therefore, not the part of wisdom to make a positive diagnosis from the eruption alone, but to consider carefully every associated symptom and the history. Occasionally one may observe skin eruptions which are of a scarlet color and are produced by quinin or antipyrin or belladonna. In such instances the injection of the deep layers of the skin and the uneven feel which are so characteristic of scarlet fever are absent. The eruption which may be associated with the injection of animal serums into the blood (particularly the antitoxin for diphtheria) often causes confusion, because at times it appears with considerable elevation of the temperature, cephalalgia, and vomiting (and in rarer instances with congested throat), so that the simulation to a commencing scarlet fever may be marked. Every possible fact must be weighed in these cases, and even then it is sometimes necessary

to await further development before an opinion may be reasonably given.

In cases of scarlet fever in which the eruption remains undeveloped, existing as a pale and indistinct macular rash, the danger of error is great. Such an eruption may be due to several conditions; it may be scarlet fever, it may be the scarlatinal form of rubella, or it may be due to serum injection. The history of serum injection and the absence of exposure to scarlet fever would naturally help in the differentiation of a serum rash.

Under ordinary conditions rubella occurs with little or no febrile disturbance, but, on the other hand, one observes at times cases of scarlet fever with little or no temperature, so that that point of differentiation is more apparent than real. In rubella the finely punctiform eruption which is characteristic of scarlet fever is never observed, and if a careful search is made of the whole body, especially at the joints, one rarely ever fails in finding at least small patches of eruption which are characteristic in appearance. One must, however, examine carefully the mouth and pharynx, for strongly suggestive of scarlet fever are the strawberry tongue and sharply defined congestion of the velum of the palate, the palatine arches, the uvula, and tonsils. Then, again, with even a well-distributed eruption, rubella has few or no constitutional symptoms, while with a similarly distributed rash scarlet fever would exhibit many and pronounced symptoms.

The liability of diagnosing a case of scarlet fever as a case of rubeola may come from the eruption departing from its usual appearance and exhibiting a coarse macular and partly papular appearance upon some areas of the skin. The differentiation is based upon the vastly different modes of onset, the time of the appearance of the rash, and its course and distribution. The changes in the mucous membranes of the mouth and pharynx are also usually sufficient to make the distinction clear.

During infancy especially, but by no means confined to that period of life, there are observed a large variety of rashes which markedly simulate the eruption of scarlet fever. Most of these arise under the influence of digestive disturbances and are of brief duration.

Peculiarly deceptive is that mild form of acute exfoliative der-

matitis known as scarlatiniform erythema, because of its sudden onset with fever and an eruption which spreads quickly over the whole body, persisting at times for three or four days. Desquamation follows to add to the deception. As relapses are common, the history of previous attacks are of immense value, but when the attack is the first or second one, then the diagnosis may be impossible for a day or two.

Much dependence must be placed upon the conditions which are found in the oral cavity and the pharynx, which are somewhat characteristic in scarlet fever and absent in erythema. But the erythema may accompany diphtheria (this is not an uncommon happening), and in such cases I know of no way of making a positive diagnosis, except by waiting and watching the further development of the affections, or to rely upon the findings of a bacteriologic examination.

The general statement may be made that in erythema scarlatiniforme throat symptoms are absent, or amount only to very slight congestion without swelling; the rash is out of all proportion to the constitutional symptoms, and there is a tendency to rapid clearing of one area with as rapid involvement of another. When the case is seen late and desquamation is present, the differential points are as follows: in scarlet fever desquamation usually occurs first upon the face and on the fourth to sixth days; next upon the neck and chest, from the sixth to eighth day; then upon the hands, from the twelfth to fourteenth day, and lastly upon the feet about the third week. In the unmentioned parts there is no particular constancy as to the time in which desquamation occurs. Now, in all other rashes which in any way resemble the scarlet fever eruption, and which are not due to contagious disease, the desquamation almost invariably starts upon the hands and the feet, and usually some earlier than the fourth day.

Peculiarly indicative of scarlet fever desquamation is the scaling which occurs just beneath the free border of the nails and extends down the finger. One must always bear in mind that not every diffuse rash which ends in desquamation is scarlet fever; other toxins are capable of causing the same thing.

VARIOLA

Fortunately there is not now an abundant opportunity to observe this disease; still, the laxity and variety of the laws relative to vaccination in the United States allow of more chance to observe the disease than is necessary. In a consideration of the protection which is afforded by vaccination, little reliance can be placed upon the statements of parents that the operation was recently performed, but this needs corroboration by the exhibition of a proper scar. Time and time again children are vaccinated and a certificate is given of that fact, without any effort being made to determine later on if the procedure was successful or not. This gives a sense of false security to the person; hence the necessity of seeing a good scar.

The disease is one which is most highly contagious; one which affects all races and ages, but which is particularly fatal to the young child. The period of incubation is not marked by any appreciable symptoms, as a rule, but at times there may be very slight and indefinite ones, which are in no way suggestive as far as diagnosis is concerned.

The onset of the disease is very abrupt, with a decided chill in older children and convulsions in the younger child, and these have as their accompaniment a rapid rise of temperature. There may be vomiting at the onset also. The usual symptoms which accompany a high and rapid elevation of the body-temperature occur in variola with unusual intensity, and this is characteristically true of pain in the lumbar region, which is generally quite excessive.

It is not unusual for the pain to extend to the front of the body and to the inguinal region and for the case to be looked upon as one of spinal meningitis. If the child has been exposed to smallpox and is suddenly taken ill with a chill or convulsion, with high temperature and marked lumbar pain, the chances are in favor of variola; but if there has been a previous complaint made of headache, persisting for some hours or a day or two, and then a sudden seizure with rigors, convulsion, or explosive vomiting and great weakness of the limbs, the chances favor a diagnosis of meningitis.

Much care must be observed, however, to elucidate the history of exposure and of protection by vaccination.

The possibility of mistaking the disease for pneumonia at this time is rather small, for in that disease, while the symptoms of the onset may be similar in many points (sudden high temperature, vomiting, chill, or convulsion), the lumbar pain is absent, and the respirations are increased out of all proportion to the pulse (and there may be cough and rough respiratory murmur even at this early stage).

Not uncommonly, while the fever is present, there occurs a diffuse redness of the skin, which is uniform and most noticeable upon the trunk. In the triangular space bounded above by a line which would cross the umbilicus and an apex formed by the closed thighs, the sides of the triangle being bounded by the inguinal regions, there is a still more intense reddening (occasionally with purpuric areas).

There may occasionally be erythematous patches in various portions of the body. The possibility of mistaking this prodromal eruption for scarlet fever rash is small, although with a hasty examination such an error might occur. At this time, if there is anything which compels the child to breathe through the mouth, then there is considerable pain in the throat, which is occasioned by the intense dryness of the mucous membranes.

The phenomena of the stage of invasion last for two or occasionally for three days, when, with a marked remission of the fever, a general improvement of all the symptoms occurs, and at the same time the characteristic eruption makes its appearance upon the skin. The face is the first portion affected, but during the succeeding forty-eight hours the eruption spreads over the trunk and the limbs. Usually the eruption is developed with an associated redness of the face which may be more or less diffuse.

The first appearance is somewhat like that caused by the bite of a flea, for there are sharply defined, circumscribed, red nodules which are first observed upon the face (and occasionally upon the forehead and scalp there may be noted hard nodules which feel like shot, but upon which no redness is seen), while at the same time, upon the dorsal surface of the hand, upon the forearms, and sometimes upon the trunk and neck, similar hard nodules are noted,

but with intense redness. These develop into small papules within two to three days, and after twenty-four or forty-eight hours more they become vesicles which at first contain clear fluid, which rapidly becomes turbid.

It is usually on the seventh day of the disease that the typical vesicle is fully formed. This is a flat vesicle which shows in its center a slight depression (umbilication). Upon the eighth or ninth day, as a rule, the vesicle has developed into a pustule. About the eleventh or twelfth day the pustule begins to dry and there is an associated itching with the process. The pustules partly rupture (may be occasioned by scratching or rubbing), and as the contents exude they dry, forming crusts. In those pustules which are not ruptured the contents dry slowly with a decrease in the surrounding hyperemia of the skin. The crusts are thrown off toward the end of the third week of the disease, and if the pustules have been located deeply in the true skin, pitting occurs.

Now, to return to the constitutional symptoms: the fever, which remitted when the eruption first appeared, reappears with the further development of the rash, and may assume quite as high a degree as the initial fever. With the drying up of the pustules the fever subsides slowly by lysis.

About this period various and rather severe nervous phenomena are very apt to be present, on account of the fever, the pain which is caused by the development of the pustules upon an unyielding skin (as upon the soles and palms), and from the inflammation of the skin and also from the toxic effect of the numerous foci of pus. Focal affection of the brain and spinal cord or of the peripheral nerves usually adds to the difficulty, and it is easy to understand that with a disease with such innumerable pus foci the most varied metastatic inflammations may arise.

There are three almost universally recognized varieties of the disease:

(*a*) Discrete variola, in which there are few pocks and these are separated by intervening perfectly normal skin.

(*b*) Confluent variola, in which the pocks are closely crowded, so that they coalesce, and the distribution is pretty general over the whole of the body. In this form the symptoms are usually

all intensified and the eruption may appear earlier than the usual time.

(*c*) Malignant variola, in which blood is exuded into the skin and mucous membranes, so that one may observe petechiæ and ecchymoses in the skin and more or less profuse hemorrhages may occur from any of the mucous surfaces. The eruption in such cases is usually much delayed or may be entirely absent.

When the eruption of variola is well developed, there is usually no difficulty in making a diagnosis, but the highly contagious nature of the disease and the tenacity of the contagious principle demand that the earliest possible diagnosis be made.

The greatest difficulty will naturally be offered by the modified form of the disease—varioloid. Varioloid occurs in a person who is practially protected by a previous vaccination, or who offers some degree of immunity from other causes. Besides its mildness, which is its marked characteristic, it differs from variola in that the development of the symptoms is very irregular.

In children the initial symptoms are usually just as severe as in variola and erythematous rashes are commoner, but the manner of the distribution of the eruption may be totally different (occurring at times upon the face last). Generally when the eruption reaches the vesicular stage the further development is arrested and the vesicles dry up about the sixth day. Pustules may possibly form, but they do not fully develop. There is generally little or no secondary elevation of temperature, and the eruption is discrete. A safe rule is to always suspect the severer form until it can be clearly and undoubtedly shown that the modified form is present.

During the papular stage of the eruption, as long as the eruption remains maculopapular and of a dusky red color upon the face, it may readily be mistaken for rubeola. This error, however, is much more liable to occur in adults than in children, on account of the delicacy of the skin during childhood allowing a freer development. Such errors might be more easily avoided if one recalled that the eruption of measles occurs later than does that of variola, and that the catarrhal symptoms which are present in rubeola are usually well marked and precede the eruption by several days (usually three or four). While the absence of Kop-

lik's spots would be of no deciding value, their presence would at once determine the presence of rubeola. It might be helpful in some cases to make an examination of the urine, and the presence of the diazo-reaction at the time of the appearance of the eruption would favor the diagnosis of rubeola.

It may occur at times that the greatest uncertainty obtains in regard to the preceding history of the case at the time of the first appearance of the eruption, and in that case delay is necessary before an opinion may be expressed as to anything positive. If within twenty-four hours the spots have not enlarged, but have simply increased in number and assumed a bluish-red color and the fever continues to rise, then the diagnosis of rubeola may be made without further delay. Urticaria may occur in a papular form which may closely simulate the eruption of smallpox, but it is always accompanied by more or less intense itching, and the whole history is totally different.

The differentiation from varicella will be found under the section dealing with that disease (see page 511).

Just a word in regard to abortive variola: it differs in no way at first from the regular form of the disease, but all symptoms are limited to the prodromal period. The diagnosis must be made upon the appearance of the prodromal rashes in the typical situations and upon etiologic factors. There is no eruption.

VARICELLA

This acute infectious and epidemic disease is evidenced by mild constitutional symptoms and a vesicular exanthem which occurs in successive crops. Usually the exanthem is the first thing noticed, but there may be at times prodromes which are in no way suggestive (anorexia, slight elevation of temperature, restlessness, cephalalgia, etc.).

In a very large proportion of the cases the eruption is the first symptom, and appears upon the face and then spreads to the scalp, the trunk, and finally the extremities, or may appear primarily upon the back and shoulders. But whatever the situation of the first appearance, the whole body is finally spotted with the eruption, which shows a marked tendency, which amounts to a charac-

teristic, to become most noticeable upon the trunk and upon the upper portions rather than upon the lower.

An erythematous rash may appear before the eruption, and when this occurs, the peripheral lymph-glands are generally somewhat tender and may be swollen also. The disease is very benign and occurs in nearly every instance before the age of seven, and after ten years of age it is rather an unusual occurrence.

The eruption is of small, red, scattered, flat, circular or ovoid papules. These come out in successive crops. The papule rapidly develops into a vesicle, the evolution occupying about twenty-four hours or a much shorter period. At first the vesicle is generally hemispheric and superficially located, with limpid contents, so that commonly the appearance is as though a drop of some faint yellow fluid had been placed upon the skin.

This appearance does not last long, for within a few hours they take on a milky color and finally become seropurulent. Then another change occurs, for desiccation takes place, with the formation of flat yellowish-brown crusts which are firmly adherent, but which separate in about one week without scarring. Rupture of the vesicles does not occur spontaneously, but from rubbing or scratching, and under such conditions slight scars may result. The vesicle is not surrounded by any area of hyperemia or infiltration except in rare instances.

The foregoing description applies only to the first few crops of the exanthem, for later in the affection the papules do not, as a rule, develop into vesicles, but dry up and undergo complete absorption within about twenty-four hours. These later papules are also much less numerous than the earlier crops.

The rapid changes which occur in the pock, and the fact that they appear in successive crops, give us, by the fourth or fifth day of the affection, the characteristic appearance of an eruption in all stages of evolution and involution. The number of the pocks may vary from a very few to several hundreds, but even when thickly crowded, it requires very careful search to detect any confluence. Umbilication is never seen except as desiccation takes place, and then occasionally a central depression is observed in the crust.

When the affection is mild, no fever is present, but in severe at-

tacks there may be a slight elevation before the appearance of the rash; but if not present at the time, it occurs coincidentally with the eruption. The temperature may remain elevated for two or three days, or more rarely it persists for a week, but in any event conforms to no regular type.

In rare cases the vesicles may contain some blood and be associated with slight bleeding from the mucous surfaces. Still rarer are the instances in which bullæ are developed or gangrene occurs.

The diagnosis is very easy if the case is seen from the beginning, but such is not usually the fact. Then the diagnosis has to take into consideration a discrimination between varicella and variola, or between the former disease and impetigo contagiosa.

In regard to the differentiation from variola, we inquire at once into the vaccinal history. Regardless of such, we observe that the initial symptoms are usually severe in smallpox and are present for from two to three days before the eruption, and that at the time of the appearance of the eruption the fever suddenly subsides. The onset of variola is abrupt usually, with high temperature, headache, and, what is most characteristic, with severe lumbar pain, which is out of all proportion to the constitutional symptoms present. But the onset of variola may be accompanied by very mild symptoms and the onset of varicella by very severe ones; and these unusual cases are the puzzling ones. Then the points to be considered are that in varicella the fever and the eruption appear together (or if fever precedes the eruption, it is mild and becomes more severe at the time of the appearance of the rash), while in variola there is a marked remission of the fever at the time of the appearance of the eruption.

The eruption of variola is most marked on the face, hands, and feet; in varicella, upon the trunk and back, and particularly the upper portions of the same. Further than this, in variola the eruption has a fine shotty feel, and the development is slow and by progressive stages of papule, vesicle, pustule, and crusts, while in varicella the rash is vesicular in a very short time, with a soft feel and easy rupture. If the varicella vesicle be artificially ruptured, the contents are readily discharged; if a similar process is attempted with the vesicle of variola, the contents will not exude,

except with difficulty. The varicella eruption is not primarily umbilicated, but in variola it is.

When the case is seen late, there may be a marked resemblance to impetigo contagiosa, for there is now desiccation of the vesicles. The distinguishing features are that in impetigo contagiosa the vesicles formed are thin-roofed and flaccid, and these or the blebs become pustular, rupture, and form superficial crusts. The face is usually the only part of the body affected, or from this there may be distinctly traced an eruption which follows closely inoculation by the fingers (through scratching). There are no general symptoms and a rather chronic course is the rule.

DIPHTHERIA

This highly contagious disease is common, because of its being directly transmissible from one child to another, or indirectly to the child through the agency of a third person and infected fomites. While there is no exemption which is offered by age, still the disease occurs with greatest frequency between the ages of two and six.

There is no well-marked difference in its occurrence in the different seasons, although the catarrhal conditions which are usually present in the fall and winter must predispose to its occurrence. Whether the child be under the best hygienic conditions or not does not make much difference; all are attacked with equal virulence.

It is a constant revelation to one who sees many cases of diphtheria that the disease naturally divides itself into two classes: the mild form, in which the area of the disease is limited and the toxins quite harmless, and the severe form, in which local limitation does not obtain and the intoxication is extreme.

It might be presumed that in a disease which is so characteristically developed, with local symptoms, the diagnosis would be very simple, and up to a certain point such is the case. But even with the wide experience which is of such value in the recognition of the disease, there occur frequently cases in which one cannot be positive of the diagnosis without a confirmatory culture.

The prodromes are so uncertain that there is rarely a recognition of them. There may be evidences of a slight chilliness and malaise, and perhaps some congestion of the fauces.

If the case be one of the mildest type, there may be evidences of a moderate catarrhal inflammation of the fauces, of the pharynx, or of the nose, associated with some tenderness and slight swelling of the cervical glands, and nothing more of a local nature. If the nose is involved, there is usually the discharge of a blood-streaked, irritating, and thin secretion. Constitutional symptoms are usually mild, the only one of any import being a slight elevation of the temperature.

Such mild attacks are dangerous in several ways: first, they are usually not recognized at once; second, they infect others; and, third, they may be followed by sudden and severe laryngeal involvement. If it became a routine practice to examine the throats of all sick children, as it should be, many of these cases would not be overlooked, for the detection of the inflammation would often lead one to adopt the only positive means of diagnosing these cases—the bacteriologic examination. A wise plan is to consider all acute inflammations, whether nasal, faucial, pharyngeal, or laryngeal, as suspicious until proved otherwise by the clinical course or by bacteriologic examination, and this applies with particular force in the presence of a known epidemic.

A more pronounced form than this just described, and still a

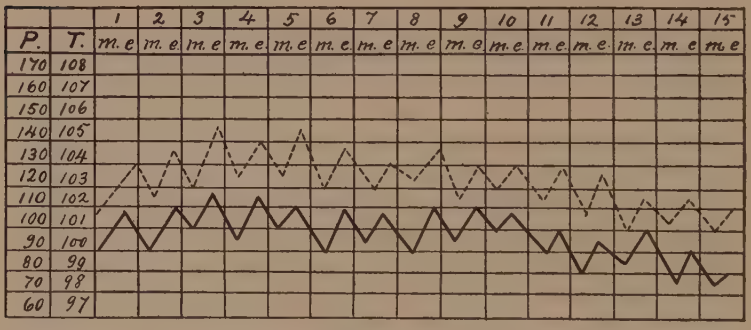

Fig. 156.—Chart of the temperature (——) and pulse (- - - -) in diphtheria. Child four and one-half years old.

very mild type, may occur with some soreness of the throat which is accompanied with mild fever and a deposit (of a white or gray color) upon one or both tonsils. It is usually the low temperature (100° to 102° F.) and the persistence of the deposit (for from four to ten days) which leads one to suspect diphtheria, for otherwise the disease seems a trivial affair, and the child usually persists in being about as usual.

The diagnosis is usually made of follicular tonsillitis, and there is nothing but a culture which will at times positively make the distinction. Unless the symptoms are so developed that doubt is practically removed beyond all question, tonsillitis should be looked upon with doubt.

When tonsillitis is present, there is almost always a marked hyperemia and usually a high temperature—much higher than seems to be expected with such local symptoms. It is generally easy to wipe away, without causing bleeding, any of the spots on the tonsils which are the result of a simple inflammation.

In the severe cases the onset may be very insidious or may occur abruptly, with some soreness of the throat and slight fever, which daily increases, or with vomiting, chilliness, marked malaise, anorexia, or headache. These may be associated with some tenderness or slight swelling of the cervical glands, which latter at times may be the first thing which is noticed.

Whether the attack be one of the milder forms or of the severe type, we have seen that there is little about the onset which is at all suggestive, and yet there is some value in the early symptoms when taken collectively.

Naturally, the first matter that one would attend to would be the question as to the prevalence of any epidemic. This would naturally lead to a study of the child's surroundings: Does he go to school and so come in contact with many children? Has he been in an infected locality? Are there other cases near by? What is his age? (If over twelve years of age, the chances of his having diphtheria are much less.) Has he ever had attacks of tonsillitis? (There is a distinct value in a clear history of repeated attacks of such, for it reveals a tendency and suggests further examination for rheumatic affection of the heart.)

There is one thing that is usually marked about the onset of diphtheria, and that is that the temperature is low (that is, taken altogether, it is lower than in other inflammations of the throat). Sudden development is the exception and not the rule in diphtheria. If during the onset there be a nasal discharge present which is irritating and blood-streaked, or if the cervical glands are tender, even without being enlarged, it is strongly suggestive of diphtheria.

For an early diagnosis dependence must be placed more upon the result which is obtained from a culture and upon the local signs than upon the general symptoms. The value of a culture must not be overestimated, however, for many times the result will be negative on one examination and positive on the subsequent ones.

On the other hand, a culture may be positive, and yet the child be free from diphtheria. What, then, is our position in the matter? Simply this: that the bacteriologic findings must be supplemental to the clinical history: the two must be considered together.

When we come to consider the local conditions, we find that the characteristic membrane usually appears at first as a thin gray film which gradually but progressively becomes more dense and perhaps whiter in color. As the membrane ages, it becomes more gray, brown, or even black. The most marked feature is its progressive spread from a small patch to a much larger one. The usual situation is at first upon the tonsils, although one is commonly affected for a day or more before its fellow, and occasionally it is confined to the one tonsil.

The membrane is not readily removed, and when any force is used, bleeding is the usual result. The fact that a membrane is apparently present is not of as much importance as the fact that it spreads, and particularly where it spreads to. If it spreads beyond the tonsil, it may be regarded, with almost absolute certainty, as diphtheritic. Or, if limited to the tonsils, but with little or no surrounding inflammation, it is most likely diphtheria.

If upon an examination of the throat we find that there is an intense degree of inflammation, and that there is some edema of the uvula and faucial pillars, or that the membrane which is present is easily removed or broken, we are quite safe in assuming that we are not dealing with diphtheria (unless it be complicated with some other throat inflammation).

There are exceptions to all rules, and so we find that in a streptococcus infection of the pharynx and tonsil, such as is common during the early course of scarlet fever, of rubeola, and some of the other infectious diseases of children, the membrane which is formed is very adherent and quite similar to that of diphtheria. There is one marked difference, however, in the associated symptoms: in streptococcus infection the elevation of the temperature is marked (105° to 106° F.), while in diphtheria low temperature obtains. If such a condition of the throat should occur late in the course of these diseases (as after four or five days' illness), then the probability of its being an added infection (diphtheria) is great.

Outside of the local symptoms we have constitutional ones,

which are dependent upon the absorption of the toxins and the resulting effect upon the functions of the various organs of the body. Therefore it is seen that in mild attacks the constitutional symptoms are so slight that one may readily be deceived in regard to the danger of the infection.

In the pharyngeal type there is usually a day or so of listlessness, anorexia, and perhaps some vomiting. The temperature is slightly elevated, the pulse accelerated, and the urine scanty and high-colored, and usually with some albumin. If the child be old enough to complain, it does so of headache and pain in the limbs and back. If a rash appears upon the skin (as is not unusual), it may resemble somewhat that of scarlet fever or rubeola, and these diseases may be suspected. The prodromes of rubeola are usually sufficient to stamp this disease at once, but when we attempt to differentiate scarlet fever, the difficulty is greater. However, it is in just such cases that the value of a bacteriologic examination is marked. If the pharyngeal type be unusually severe, there is added a considerable degree of prostration, with the temperature remaining about the same, but the pulse more rapid and weak. The skin may become cyanotic, the child semi-comatose, and the urine suppressed. There is generally a foul odor to the breath.

In the nasal type the symptoms are about the same as in the foregoing type, with the added ones of epistaxis, or the discharge of blood-streaked secretion which excoriates the skin. Mouth-breathing is common, and the temperature is usually more elevated and the glands in the neck markedly swollen. These symptoms are added to those of the pharyngeal type because it is common for both to exist together, and unusual for them not to.

It will be well to consider the symptoms which accompany the laryngeal type more in detail, for the experienced physician will always view with much alarm the occurrence of any symptoms which denote a laryngeal involvement or which evidence its increase when already present. The most characteristic symptom of laryngeal involvement is thickness or hoarseness of the voice or cry, with the probable associated symptoms of a dry, harsh, and barking cough and stenotic breathing.

In nearly all instances the involvement of the larynx occurs while the membranes are still present in the pharynx, but some-

times it is not evidenced until the membranes have entirely disappeared. In other instances it is secondary to a nasal diphtheria, in which there may have been little or no involvement of the pharynx.

Of course, with such a severe disease we occasionally notice that a catarrhal laryngitis occurs, but the moment a rough, harsh cough occurs with hoarseness of the cry or voice, suspicion should be at once aroused that the larynx is affected and an exudation forming there. Reflex cough occurs in the pharyngeal type without any laryngeal involvement, but in that condition the cough is clear, distinct, and hacking, and the voice is not muffled or hoarse. It is frequently noted that the cough and hoarseness are improved during the daytime and become more marked at night, and such an occurrence in itself should arouse suspicion.

Dyspnea is very real, so that the child has an anxious expression, the eyes are generally widely opened, the alæ nasi dilating with each respiration, and with each of the more or less long and hissing inspirations there is a very evident participation of all or most of the accessory respiratory muscles in the act of respiration. Unless relief is quickly obtained, cyanosis soon comes on. About this time convulsions are common, and the little one may at any time sink into a deep coma, with the cyanosis marked, the pulse feeble and very rapid, the respiration gasping, and the whole picture one of intense distress and of impending death.

When the diagnosis of the disease has been made and its extent determined, there is still much left for the diagnostician to consider.

There are many important sequels which must be recognized early, and perhaps the chief of these are the cardiac symptoms. We are often at a loss to explain the loss in the action of the heart, and this is particularly true when death occurs rapidly, while in the more protracted instances there are well-marked cardiac changes, which are easily recognized. It is most important to treat the cardiac condition before it occurs and there are some symptoms which prophesy its onset.

Vomiting occurring during the course of diphtheria, unless it can be clearly explained as due to some other cause, ought to place us in a position of great suspicion, at least. The same may

be said of a persistent coldness of the limbs. When either of these are present, no matter what the apparent condition of the heart muscles may be, cardiac involvement should be looked for.

It is not always necessary to wait until we obtain the more positive signs of arrhythmia or increasing dullness of the heart-sounds. Sometimes, when an examination is made, it is noted that the cardiac impulse is weakened, and upon auscultation there are heard what seem to be three heart-beats, with the middle one particularly accentuated. When the heart is involved, death may take place in one of two ways: suddenly and almost without warning during an attack of vomiting, or slowly with varying collapse-like attacks.

It is a well-recognized fact that a severe attack of diphtheria

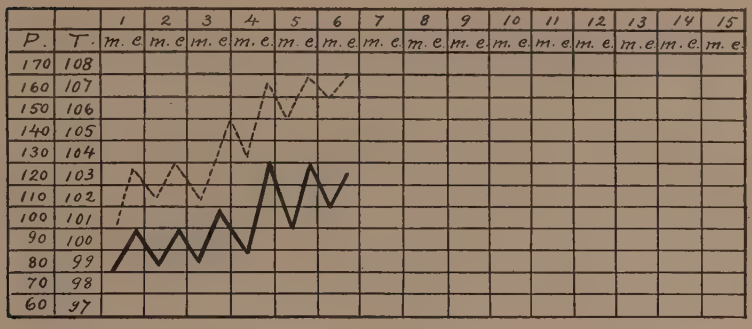

Fig. 157.—Chart of the temperature (——) and the pulse (- - - -) in diphtheria. Child five years old. Death occurred suddenly upon the evening of the sixth day. While the case was treated in expectancy of cardiac paralysis, this was not actually evidenced until the evening of the third day, when the disproportion between temperature and pulse gave the first warning, irregularity of the pulse soon being in evidence. Death came with a mild vomiting attack.

rarely, if ever, occurs without some pathologic involvement of the kidneys. Such an involvement may be shown by albuminuria, diminution in the amount of urine, or renal hemorrhages. Unlike most other renal involvements, in diphtheria, dropsy and the occurrence of the uremic symptom-complex are both rare. Acute nephritis is an occasional sequel which may not occur until convalescence is well established, or it may come on several weeks later.

Diphtheritic paralysis is an important sequel, and divides itself

into two groups—the early and the late. Early paralysis occurs in the more severe cases, and always begins in the velum of the palate. It is associated with severe prostration and accompanied by adynamic cardiac conditions, being almost uniformly fatal.

The late paralyses are commonly known as post-diphtheritic, and occur from two to five weeks after the onset of the diphtheria, as a rule. The palate is usually the part most affected, and the first symptom noted may be a nasal twang to the voice, or difficulty in swallowing, so that the child in the attempt brings through the nose some of the liquid which is taken. In cases in which it is watched for (and this is unusual in private practice, as a rule) the patellar reflex is absent, and this is a very early symptom. The development of post-diphtheritic paralysis is not regular. If the absence of the knee-jerk be associated with albuminuria and a general lassitude of the patient, and the preceding history has been of an attack of diphtheria (or even of severe sore throat), one is justified in suspecting the onset of paralysis.

At the time that the palate is first involved (as evidenced by the changed voice) there is more or less tingling and weakness in the extremities, and particularly the legs, although it is rarely sufficient to cause the child to complain. The paralysis may involve the palate alone or extend to the musculature of the pharynx and larynx also. Many times the paralysis will be apparently limited to the throat, but a careful search will reveal some degree of paralysis in other parts.

Next in frequency to the throat involvement the legs are usually affected, and the symptoms do not differ from those which are caused by multiple neuritis from other causes, except in the absence of pain. When the legs are affected, there is usually an inability to use the eyes for close work also, or there may be strabismus.

It must not be expected that the paralysis of the limbs will be complete; in nearly every instance there is simply an evidence of a more or less marked weakness and flabbiness. Paralysis affecting the arm is of evil import, usually predicting cardiac paralysis. The recovery from the paralysis is complete when it occurs.

Respiratory paralysis may occur, and the first warning is usually the occurrence of dyspnea, with an empty toneless cough, the

attacks increasing in severity and sometimes in frequency as time goes on.

It is very important to recognize the important sequels as early as possible; it is more important that they be anticipated and the treatment be such as to limit their occurrence.

RHEUMATISM

To make an early diagnosis of rheumatism in the child is of great importance. That much must be admitted, for without an early and positive recognition of its existence, incalculable damage may result to the child. The main object in the recognition of rheumatism at an early stage is the prevention of cardiovascular changes.

In approaching the subject we must leave behind all preconceived ideas and deductions which we have acquired by our study of adult cases, for rheumatism in the child is markedly different in its clinical aspects from the similar state in the adult.

A rheumatic arthritis *per se* has little to do with the cardiac changes which occur in the child. These little ones are injured while suffering from a faulty metabolism and may suffer severe damage to the heart without ever having had any arthritis, or, in fact, any of the usually recognized symptoms of rheumatism, except the so-called growing pains, leg cramps, iritis, myalgia, tonsillitis, or chorea. Arthritis, strictly speaking, is not the cause of the cardiovascular changes; the diathesis which causes the one, induces the other.

The earliest possible recognition of the existence of rheumatism in the child is offered by a correct estimation of the functional capacity of the heart, for in no other condition is functional perversion so constant. Probably one of the best methods of testing the functional capacity of the heart is that which is known as Herz's arm-flexion test. The diagnostician supports the elbow of the patient by letting it rest upon his hand, and with the other hand the wrist of the child is very lightly grasped. The child is then told to concentrate his attention as closely as possible upon what he is about to do. Then he is requested to perform a very slow and uniform flexion of the forearm, and this is not to be resisted by the examiner. As little effort as possible is to be put into the movement. After flexion, there must be an equally slow and deliberate extension.

The pulse, which should have been previously counted, is then immediately counted as extension is completed. Now, if the myocardium is not absolutely normal and sound, a very noticeable difference in the two takings of the pulse is observed. In abnormal conditions there will be noted a slowing of the pulse-rate, but an increase in the size and strength of the pulse-wave. If the functional capacity be normal, nothing but a slight acceleration is observed.

My favorite method has always been to give the child a small dose of digitalis (one minim to a child of seven years) and note whether there is any appreciable difference in the rate or quality of the pulse under conditions similar to those which existed previous to the giving of the drug. A perfectly normal heart should not be affected by such a dose.

I emphasize the importance of the cardiac changes because they are so frequent and so prominent. Their influence upon the course and the outcome of the disease is so marked that at times it might almost leave one in doubt as to whether or not they should be considered as the typical characteristics of the disease. As has been stated, the cardiac changes or manifestations may occur when articular symptoms are very mild or absent entirely.

The most frequent form of cardiac disease is endocarditis, which is observed in all severe cases and in a very large proportion of all cases. It is not always recognized at first, so that the child may suffer two or more attacks of the articular symptoms before the cardiac condition is recognized. In many instances the cardiac changes are first noted and the articular symptoms follow apparently. In children who are over eight years of age there is frequently a pericarditis associated with an endocarditis; under the age of eight, pericarditis is not so frequent.

Still, it is not simply by one or two particular symptoms that the disease is recognized in childhood, but by the combination or association of a number of symptoms which may apparently be unrelated. An illness which has an abrupt onset, with slight fever and tenderness, but with general symptoms which are indefinite, is strongly suggestive of rheumatism.

There are certain factors which are very helpful in the diagnosis, particularly the family history and the previous condition of the

patient. The influence of heredity is very strong, and a child of rheumatic parentage is very liable to develop the disease in some form in the presence of very slightly active causes. If both parents be rheumatic, then the liability is much increased. Early in life boys seem to be more often affected than girls, but between the ages of five and ten the sexes are about equally susceptible; between ten and puberty, girls are most affected.

The previous condition of the patient must take cognizance of the existence of indefinite muscular pains, articular swellings, joint stiffness, the so-called growing pains, the previous occurrence of attacks of tonsillitis, chorea, torticollis, and erythemas. When the suspicion is once aroused that there is a rheumatic tendency, any symptoms which arise and cannot be definitely explained should be suggestive of rheumatism.

An attack of rheumatism may begin very insidiously, with slight fever, some indisposition, and anorexia. One or more joints may be tender, but at times to such a slight degree that it is overlooked, or the tenderness may rapidly shift from one joint to another. When there is joint or muscular tenderness, beginning in such a way and without a clear history of injury, it must always arouse suspicion of a rheumatic origin. At other times the joints may simply be somewhat stiffened. When the infection is of such a nature as the foregoing, it is more often overlooked than mistaken for other conditions.

In other instances the attacks may be rather sharp and severe and the joints acutely swollen and painful. In such cases the temperature is usually high and prostration more marked, and, instead of clearing up in a week or two, the condition persists for from three to five weeks. In these instances the heart condition may be serious from the very start and anemia becomes a marked feature. Anemia is usually so sudden and severe that there is danger of mistaking the anemic murmurs for those due to endocarditis.

In the cases which exhibit serious cardiac changes there may at times be observed the development of subcutaneous nodules which vary in size up to that of a small nut. They may persist for months and are always indicative of a tendency to serious cardiac involvement.

The infrequency with which rheumatism occurs in infancy should always make one very guarded in the diagnosis of the disease during that period of life. The commonest mistake is to consider the symptoms which are due to scurvy in the infant as dependent upon rheumatism. If the pain and tenderness are confined to the lower limbs, even without the usual associated affection of the gums, and the patient is an infant, it is safe to consider the symptoms as due to scurvy, if an etiologic factor be present. It may be that the evidences of pain upon handling may be attributed to rachitis, but in such cases the other evidences of rachitis are always marked enough to allow of no error.

The symptoms of rheumatism are so variable, and so insignificant at times, the course so indefinite, and the results to the heart so disastrous, that much depends upon a recognition of the hereditary tendency to the disease for its early diagnosis.

CRETINISM

When fairly well developed, there is little probability of cretinism being mistaken for any other condition. It is during the period of later childhood that the cases are more easily recognized. During the early developmental period of life, when the stunted growth and mental condition of the infant are not in such strong contrast to what is normal, the difficulties of early recognition are more marked.

While the mental condition of these children is very striking, it is only a part of the general arrest of proper development. In sporadic cretinism there is a complete absence of the thyroid gland (either actual or functional), and this is determined by the clinical factors which are evidenced. The chief of these is the arrest of development, while the facial expression, the thick and everted lips, the broadened nose with a depressed root, the enlargement of the tongue, the lordosis and peculiar dryness and cyanosis of the skin, add to the picture. Usually the limbs are much shorter in proportion to the body than is natural. The condition would be much more readily recognized if the strong hereditary influence was recalled, and if every baby whose mental development did not seem to keep pace with its

physical growth (early in the condition, the infant appears somewhat stunted, but fat) was looked upon as a suspect.

Fig. 158.—Cretinism (side view).

Fig. 159.—Cretinism (front view).

The value of the administration of some preparation of the thyroid gland would soon aid in determining the real cause of the symptoms.

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